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FLOOD INSURANCE STUDY



**CLERMONT COUNTY,
OHIO**

UNINCORPORATED AREAS



REVISED:

SEPTEMBER 29, 1989



Federal Emergency Management Agency

COMMUNITY NUMBER - 390065

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NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

This publication incorporates revisions to the original Flood Insurance Study. These revisions are presented in Section 9.0.

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Flood Boundary and Floodway Map

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Flood Insurance Rate Map

FLOOD INSURANCE STUDY
COUNTY OF CLERMONT,
UNINCORPORATED AREAS, OHIO

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the unincorporated areas of Clermont County, Ohio, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study will be used to convert the unincorporated areas of Clermont County to the regular program of flood insurance by the Federal Insurance Administration (FIA). Local and regional planners will use this study in their efforts to promote sound flood plain management.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than those on which these Federally-supported studies are based. These criteria take precedence over the minimum Federal criteria for purposes of regulating development in the flood plain, as set forth in the Code of Federal Regulations at 44 CFR, 60.1 (d). In such cases, however, it shall be understood that the state (or other jurisdictional agency) shall be able to explain these requirements and criteria.

1.2 Authority and Acknowledgements

The source of authority for this Flood Insurance Study is the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by Woolpert Consultants for the Federal Insurance Administration, under Contract No. H-4757. This study was completed in September 1979.

1.3 Coordination

Streams requiring detailed and approximate study were identified at the initial coordination meeting attended by representatives of the Study Contractor, the FIA, the Ohio Department of Natural Resources (ODNR), and Clermont County, in April 1978. Hydrologic and hydraulic analyses for the Ohio River and the Little Miami River, and the hydrologic analysis for the East Fork Little Miami River were coordinated with the U.S. Army Corps of Engineers (COE), Louisville District, and ODNR data of Historical Flood Profiles. On August 27, 1979, flood elevations, flood boundaries, and floodway delineations were reviewed with and approved by county officials.

On May 23, 1980, the results of the work by the Study Contractor were reviewed and accepted at a final coordination meeting attended by representatives of the Study Contractor, the ODNR, the FIA, and county officials.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the unincorporated areas of Clermont County. The incorporated communities within the county were excluded from this study. While the incorporated areas of the Villages of New Richmond and Milford are not included in this study, flooding caused by streams which flow along the corporate boundary of these communities has been added to this study utilizing previously compiled data. The area of study is shown on the Vicinity Map (Figure 1).

The areas studied by detailed methods were selected with priority given to all known flood hazard areas, and areas of projected development or proposed construction through April 1983.

Approximate methods of analysis were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to and agreed upon by the FIA and the unincorporated areas of Clermont County.

The flooding sources studied by detailed methods are listed below:

- a. the Ohio River, within the county boundaries;
- b. Bullskin Creek, within the county boundaries; at
- c. the Little Miami River, from the Village of Milford corporate limits to the City of Loveland corporate limits;
- d. Stonelick Creek, from its confluence with the East Fork Little Miami River to 7.12 miles above the confluence; and
- e. the East Fork Little Miami River from 6.15 miles above its mouth at the Little Miami River to 37.4 miles above its mouth, excluding the incorporated communities of Williamsburg and Batavia.

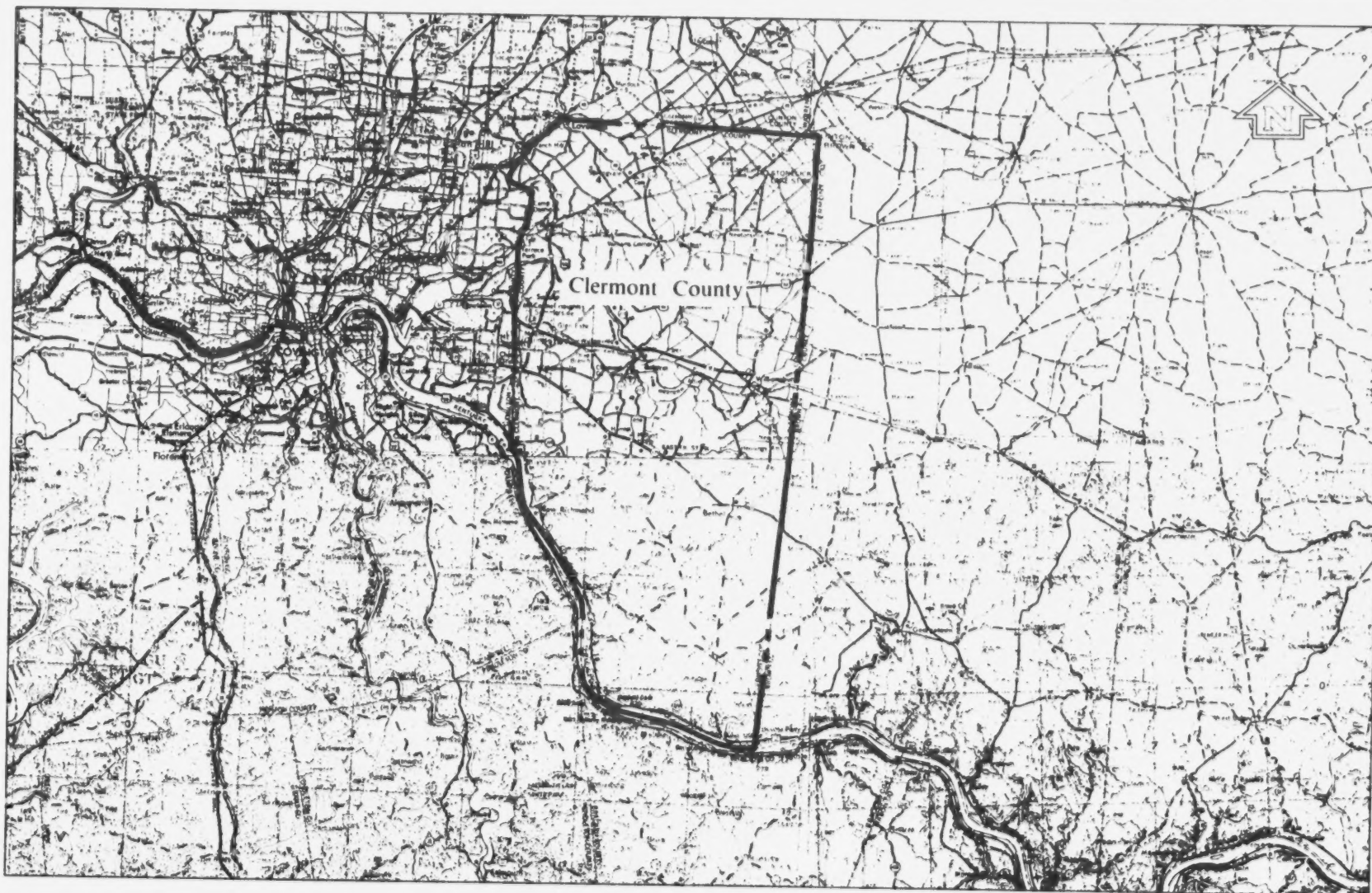


FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLERMONT COUNTY, OH
(UNINCORPORATED AREAS)

APPROXIMATE SCALE

8 0 8 16 24 MILES

VICINITY MAP

2.2 Community Description

Clermont County is in southwestern Ohio, immediately north of the Ohio River. It has a total land area of 459 square miles, or 293,760 acres. Batavia, the county seat, but not the largest town, is centrally located in the county. It lies about 90 miles southwest of Columbus, the State Capital, and 20 miles east and somewhat south of Cincinnati. Clermont County is surrounded by Brown County to the east, Warren and Clinton Counties to the north, Hamilton County to the northwest and the Ohio River along its southwest border (Reference 1). In 1970, the population of the county was 95,725 and the population of Batavia was 1,894. The largest town in Clermont County is Milford, which had a population of 4,776 in 1970.

The towns between U.S. Route 52 and the Ohio River were founded in the early 1800's with Chilo and Moscow being founded in 1816. The Town of Susanna, originally laid out in 1814, combined with the Town of New Richmond, and was incorporated as the Town of New Richmond in 1828. New Richmond has remained the largest of the riverfront towns in Clermont County to the present time (Reference 2).

The climate in the area is characterized by warm summers with temperatures occasionally rising above 90 degrees Fahrenheit (F.) and moderately cold winters with temperatures dropping to near 0 degrees F. The annual precipitation over the area averages 39.5 to 41.5 inches with most of the precipitation occurring during the winter and spring seasons (Reference 3).

Most of the acreage in Clermont County is used for farming. Tobacco, corn, soybeans, wheat, and hay are the principal crops. The western part of the county, the part nearest Cincinnati, is urbanizing quite rapidly, and considerable acreage has been rezoned from agricultural to residential, educational, and light commercial. The county lies entirely in the glaciated region of Ohio. All of the county is covered by old, deeply leached, glacial drift of Illinoian age. Where erosion has dissected the Illinoian till plain, the larger streams have cut valleys that are 200 to 400 feet deep. The drainage waters of the southern third of Clermont County flow directly into the Ohio River, while the rest of the county drains into the Little Miami River, a tributary of the Ohio River (Reference 4).

The Ohio River, formed at Pittsburgh, Pennsylvania, by the junction of the Alleghany and Monongahela Rivers, falls 429 feet in its 981-mile southwesterly course to the Mississippi River at Cairo, Illinois. Major tributaries to the parent stream are: the Little Kanawha, Kanawha, Big Sandy, Licking, Kentucky, Green, Cumberland, and Tennessee from the south; and the Beaver, Muskingum, Hocking, Scioto, Little Miami, Great Miami, and Wabash from the north. The Ohio River forms the state boundary with Ohio and Kentucky.

The Little Miami River forms part of the boundary of Clermont and Hamilton Counties. The river, with a drainage area of 1,203 square miles above the Village of Milford, has its source in Clark County, Ohio, and flows southwestwardly through Clark, Greene, Warren, Clermont, and Hamilton Counties to its confluence with the Ohio River at Cincinnati, Ohio.

The East Fork Little Miami River, with a total drainage area of 429 square miles, flows in a southerly, westerly, and northerly direction through the county. It is the largest tributary to the Little Miami River. The East Fork has its source in Clinton County and drains portions of Warren, Highland, Brown, and Clermont Counties. The stream is 83 miles long and has an average slope of 7.6 feet per mile (Reference 5).

Two other streams studied by detailed methods include Stonelick Creek, a tributary to the East Fork Little Miami River and Bullskin Creek, an Ohio River tributary.

The majority of the area flooded by the Ohio River lies between U.S. Route 52 and the Ohio River. Within the flood plain studied, development is primarily residential dwellings. Flood plains are undeveloped for all other streams not studied in the county. Two electric power plants, one under construction, lie along the Ohio River.

2.3 Principal Flood Problems

The major flood season for the major streams in Clermont County occurs from midwinter to midspring. The largest flood of record, in January 1937, caused 1.5 million dollars worth of damage in Clermont County. No fatalities occurred due to the flood (Reference 6).

Since 1921, the Ohio River has exceeded flood stage 41 times in Clermont County, an average of 8 times in a 10-year period. The 10 highest floods ranged from 7 feet to 27 feet above flood stage. Present flood stage for the lower pool at the Captain Anthony Meldahl Locks and Dam at River Mile 436.2 is 51.0 feet. The highest recorded flood on the Ohio River was that of January 1937. This flood crested at 80.0 feet in Cincinnati, 4 feet above the 500-year flood level. The second highest recorded flood, that of March 1945, was about 11 feet lower and had a recurrence interval greater than 100 years. The latest flood of major proportions occurred in March 1964, about 1.0 foot lower than the 1945 flood (Reference 2). Flood stage was exceeded in December 1978 and in February 1979. For the reach of the Little Miami River, the 2 largest floods occurred during this period: March 1913 (Milford gage height of 25.2 feet and estimated discharge in excess of 80,000 cubic feet per second (cfs); and January 1959 (gage height of 22.3 feet, discharge of 84,100 cfs). Flood stage for the Milford gage is 17 feet. The 100-year flood discharge at the gage is 85,000 cfs. Flood stages on the Little Miami River near Milford can rise from normal flood stage within 1 to 2 days. The flood pool elevation at East Fork Lake is 795 feet. Floods on the Little Miami River are caused by both rainfall and combinations of

rainfall excess and snowmelt. The duration of time above bankfull stage at Milford is 30 hours for the 100-year flood and 36 hours for the 500-year flood. The January 1937 flood was the most devastating in the area from Milford to the mouth of the Little Miami River; however, this condition was a result of Ohio River backwater (Reference 5). The largest flood of record on the U.S. Geological Survey (USGS) gage at Perintown, on the East Fork Little Miami River, approximately 6 miles downstream of Batavia, was in March 1964 (gage height 23.8 and a discharge of 42,400 cfs). Prior to construction of the East Fork Reservoir, this discharge and stage were equivalent to a 50-year flood. Records on the Perintown gage have been kept for 54 years (Reference 3). The largest flood of record at the USGS gage in Williamsburg was also in March 1964. This flood had a discharge of 19,800 cfs and was approximately a 30-year flood (Reference 3).

2.4 Flood Protection Measures

Two major flood protection projects on Little Miami tributaries which have some effect on Clermont County are currently in operation by the COE. Caesar Creek Lake is located about 3 miles upstream from the confluence of Caesar Creek with the Little Miami River, 40 miles upstream of Milford. This project controls a drainage area of 237 square miles, about 20 percent of the drainage area above Milford. East Fork Lake, located approximately 20 miles upstream of Batavia, was constructed as a flood control and recreational area, and controls a drainage area of 342 square miles (Reference 5). The park was dedicated in August 1978. Regulation of the flow by the project has reduced the 100-year flood discharge at the Perintown gage from 46,100 cfs (Reference 3) to 22,900 cfs (Reference 7). The flood pool elevation for East Fork Lake is 795 feet.

On the Ohio River, there are no natural or manmade flood protection structures, such as levees or floodwalls, that directly affect flooding in the county. However, the system of upstream tributary reservoirs that affect flood heights on the Ohio River in Clermont County were taken into consideration for this study. The Meldahl Dam, which regulates the lower stages of the river, has 12 control gates, each with 100-foot spans between piers and a 310-foot open crest fixed weir. The piers produce local swellheads only. As flows increase during floods, the gates are lifted progressively above the river crests in a manner that avoids any significant increase in flood stages. At maximum opening, the gates will clear the 1937 flood by approximately 5 feet (Reference 2).

Nonstructural measures of flood protection are also utilized to aid in the protection of future flood damage. These are in the form of land use regulations adopted from the Federal Regulations which control building within areas that have a high risk of flooding (Reference 8).

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equalled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for flood plain management and for flood insurance premium rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equalled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than one year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (one percent chance of annual occurrence) in any 50-year period is about 40 percent (four in ten), and for any 90-year period, the risk increases to about 60 percent (six in ten). The analyses reported here reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for floods of the selected recurrence intervals for each flooding source studied in detail affecting the community.

The Louisville District COE established peak discharge relationships for floods of the selected recurrence interval for the Ohio River (Reference 9). Discharge frequency curves at selected gages for the Markland Pool were used to compute the values for the 10-, 50-, 100-, and 500-year floods. Effects of flood protection reservoir systems in the Ohio River basin were taken into account in these computations. The discharges used in this study were computed on the basis of 120 years of data from the Cincinnati gage records. The analysis followed the standard log-Pearson Type III method as outlined by the U.S. Water Resources Council (Reference 10). Reductions in discharges were made at confluences with major tributaries.

The obtaining and analyses of the Little Miami River data were carried out by the Louisville District COE during the preparation of a Flood Plain Information Study (Reference 5). The USGS has maintained stream gage records on the Little Miami River at Milford since 1915. It has also maintained a stream gage at Spring Valley, Ohio, from 1925 to 1935; from 1939 to 1951; and from 1968 to the present. Stream gage records were collected by the USGS near Fort Ancient, Ohio, from October 1938 to December 1951. Data from these gages were used by the COE to develop the values of the 10-, 50-, 100-, and 500-year peak discharges. The discharge values used in this study take into account the effects of the

Caesar Creek Lake and East Fork Lake facilities. The flood frequency analysis followed the standard log-Pearson Type III method as outlined by the U.S. Water Resources Council (Reference 10).

The USGS has maintained stream gage records on the East Fork Little Miami River at Perintown from 1916 to 1920 and from 1925 to 1973. It has also maintained a stream gage upstream of Batavia since 1965. The unregulated discharge data from the Perintown gage was used to develop the values of the 10-, 50-, and 100-year peak discharge (Reference 3). The flood frequency analysis followed the standard log-Pearson Type III method as outlined by the U.S. Water Resources Council (Reference 10). This data was adjusted by the Louisville District COE to reflect the effects of East Fork Lake (Reference 7). The 500-year flood discharge was extrapolated from a statistical plot of the 10-, 50-, and 100-year flood discharges. No frequency analysis was performed for the Batavia gage data. Peak discharges for the 10-, 50-, 100-, and 500-year floods in Batavia were adjusted from the Perintown gage data by drainage area ratios. The USGS has also maintained stream gage records on the East Fork Little Miami River at Williamsburg from 1950 to 1953, in 1959, and from 1971 to 1975 (Reference 3). The values computed for this gage are those used in this study. The computation of the 10-, 50-, and 100-year flood discharges followed the standard log-Pearson Type III method as outlined by the U.S. Water Resources Council (Reference 10). The 500-year flood discharge was extrapolated from these ratios by the use of statistical graphics. Discharges decrease downstream of the State Route 32 bridge on the East Fork Little Miami River because of storage capacity.

To define the discharge frequency relationship for ungaged streams in Clermont County, methods described in Bulletin 45, Floods in Ohio, Magnitude and Frequency, were used (Reference 3). Five areas are defined for the State of Ohio, with Clermont County lying in Area 3. This area covers the Ohio River basin from and including the Little Scioto River to and including the Great Miami River. Regression equations based on 82 gaging stations define the mathematical model for computing stream discharges. Values for the 10-, 50-, and 100-year flood discharges are computed directly from the equations, and the 500-year flood discharge is extrapolated from these ratios by the use of statistical graphics. Stonelick Creek and Bullskin Creek are ungaged streams studied by detailed methods and the discharges were computed as described above.

Flood Insurance Studies for the Villages of New Richmond and Milford provided additional segments of detailed study on Twelve Mile Creek and the East Fork Little Miami River, respectively (References 11 and 12). Upstream of Williamsburg on the East Fork Little Miami River, the discharge increases because East Fork Lake regulates the flow of the river.

Peak discharges for the 10-, 50-, 100-, and 500-year floods of each flooding source studied in detail in the community are shown in Table 1.

TABLE 1 - SUMMARY OF DISCHARGES

<u>FLOODING SOURCE AND LOCATION</u>	<u>DRAINAGE AREA</u> <u>SQ MILES</u>	<u>PEAK DISCHARGES (CFS)</u>			
		<u>10-YEAR</u>	<u>50-YEAR</u>	<u>100-YEAR</u>	<u>500-YEAR</u>
OHIO RIVER					
At Hamilton/Clermont county line	74,800	495,500	611,200	658,500	783,400
LITTLE MIAMI RIVER					
Downstream of East Fork U.S. Route 50 Bridge	1,706	55,300	77,600	88,000	114,000
at Milford (USGS gage)	1,203	49,800	73,700	85,000	113,000
State Route 126 near Miamiville	1,185	49,300	73,100	84,400	112,400
Northbound State Route 126 near Remington	1,162	48,000	71,500	82,700	110,200
EAST FORK LITTLE MIAMI RIVER					
Round Bottom Road Bridge (USGS gage)	476	14,700	20,300	22,900	29,400
Above Stonelick Creek	380	11,735	16,200	18,280	23,470
At State Route 32 bridge in Batavia	359	11,090	15,310	17,270	22,175
State Route 32 bridge at Williamsburg (USGS gage)	237	16,600	21,200	23,100	26,500
STONELICK CREEK					
At Mouth	77	12,315	18,220	20,900	25,200
Above Brushy Fork Creek	43	9,120	13,700	15,700	18,940
BULLSKIN CREEK					
At Mouth	53	12,100	18,000	20,690	26,600
TWELVE MILE CREEK					
Approximately 0.7 mile upstream of U.S. Route 52	20.7	5,175	7,345	270	10,200

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of the streams in the community were carried out to provide estimates of the elevations of the floods of the selected recurrence intervals along each flooding source studied in detail.

Hydraulic information for Twelve Mile Creek and Reach 1 of the East Fork Little Miami River was taken from the Flood Insurance Studies for the Villages of New Richmond and Milford (References 11 and 12). Stream cross sections for the Ohio River were obtained by the COE from topographic maps of the COE Markland Lock and Dam pool reach (Reference 2). The Markland Lock and Dam is 65 miles downstream of Cincinnati. The large density of these sections ends at the Captain Anthony Meldahl Lock and Dam which is downstream of the Village of Chilo. An additional cross section at river mile 432.2 (Reference 4) was used to extend the reach through the study area. There are no bridges or other constrictions to flood flow within the study reach.

Stream cross sections and bridge structural data for the Little Miami River data were obtained by COE personnel through field surveys (Reference 13). Cross sections for the backwater analyses of the East Fork Little Miami River, Stonelick Creek, and Bullskin Creek were obtained by the Study Contractor through photogrammetric means from aerial photographs flown in April 1978, at a negative scale of 1:9600 (Reference 14). The below water sections and bridge data were obtained by the Study Contractor through field surveys. Field data were compared to the photogrammetric data for consistency.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 4.2), selected cross section locations are also shown on the Flood Boundary and Floodway Map (Exhibit 2).

Channel roughness coefficients (Manning's "n") for water-surface computations were determined by the COE by computer modeling of backwater curves to match high water marks for the March 1964 flood (Reference 2). Roughness values for the main channel of the Ohio River were computed to be 0.031, the flood plain roughness values were determined to average 0.055. Roughness coefficient (Manning's "n") values for the Little Miami River were estimated by field inspection by the COE and varied from 0.025 to 0.035 for the channel and from 0.04 to 0.08 for the overbanks.

Roughness coefficient (Manning's "n") values used in the hydraulic computations for the detailed study streams were chosen by engineering judgment and based on field observations of the stream and flood plain areas. Aerial photo analyses were used to ensure continuity. Roughness values for the main channels of East Fork Little Miami River, Bullskin and Stonelick Creeks averaged 0.055 and the flood plain roughness values ranged from 0.04 to 0.10. The acceptability of all assumed hydraulic factors, cross sections, and hydraulic structure data was checked by comparison to historic floodwater elevations (Reference 15).

Starting water-surface elevations for the Ohio River were based on stage-discharge relationships at the Cincinnati, Ohio gage. Starting water-surface elevations for the Little Miami River were taken from the Village of Milford Flood Insurance Study (Reference 12). Starting water-surface elevations for the separate reaches of the East Fork Little Miami River, Stonelick Creek, Bullskin Creek, and Twelve Mile Creek were calculated by the slope-area method.

Water-surface elevations for the floods of the selected recurrence intervals were computed using the COE HEC-2 step-backwater computer program (Reference 16). Artificially elevated water-surface profiles caused by the backwater effect of the Ohio River did not extend as far upstream on the Little Miami River as Milford. Therefore, the flood profiles for the county are influenced only by the conditions of the Little Miami River. The flood profiles agreed with the stage frequency relationships at the Milford gage (Reference 5). The flood profiles of the East Fork Little Miami River agreed with the stage-discharge relationships at the Perintown, Batavia, and Williamsburg gages (Reference 17 and 18). The elevations for the backwater reach of East Fork Little Miami River were obtained from the Little Miami River profiles in the City of Milford (Reference 12).

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if the hydraulic structures remain unobstructed, operate properly, and do not fail. The hydraulic analyses also consider the effects of the East Fork Lake facility.

All elevations are referenced from National Geodetic Vertical Datum of 1929 (NGVD); elevation reference marks used in the study are shown on the maps.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages state and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study includes a flood boundary map designed to assist communities in developing sound flood plain management measures.

4.1 Flood Boundaries

In order to provide a national standard without regional discrimination, the 100-year flood has been adopted by the FIA as the base flood for purposes of flood plain management measures. The 500-year flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the boundaries of the 100-year and the 500-year floods have been delineated using the elevations determined at each cross section; between cross sections the boundaries were interpolated using topographic maps photenlarged to a scale of 1:9600, with a contour interval of 10 feet (Reference 19). The locations of cross sections and flood boundaries for the Little Miami River were verified using other topographic maps at a scale of 1:2400, with a contour interval of 5 feet (Reference 20). For the stream

studied by approximate methods, the boundary of the 100-year flood was taken from the Flood Hazard Boundary Map (Reference 21). Flood boundaries for the East Fork Little Miami River adjacent to Milford were taken from the Milford Flood Insurance Study (Reference 12).

The boundaries of the 100- and 500-year floods are shown on the Flood Boundary and Floodway Map (Exhibit 2). Small areas within the flood boundaries may lie above the flood elevations and, therefore, not be subject to flooding; owing to lack of detailed topographical information or to limitations of the map scale, such areas are not shown. In cases where the 100-year and the 500-year flood boundaries are close together, only the 100-year boundary has been shown.

4.2 Floodways

Encroachment on flood plains, such as artificial fill, reduces the flood-carrying capacity, increases the flood heights of streams, and increases flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, the concept of a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood is divided into a floodway and a floodway fringe. The floodway is the channel of a stream plus any adjacent flood plain areas that must be kept free of encroachment in order that the 100-year flood may be carried without substantial increases in flood heights. Minimum standards of the FIA limit such increases in flood heights to 1.0 foot, provided that hazardous velocities are not produced.

The floodways presented in this study were computed on the basis of equal conveyance reduction from each side of the flood plain. The results of these computations were tabulated at selected cross sections for each stream segment for which a floodway was computed (Table 2). Floodways for Twelve Mile Creek were taken from the Flood Insurance Study for the Village of New Richmond (Reference 11). Portions of the Little Miami River floodway extends outside of the county boundary. A portion of the floodway of the Little Miami River, Twelve Mile Creek and the East Fork Little Miami River is within areas not included. With the approval of FIA, no floodway has been shown on the Ohio River.

As shown on the Flood Boundary and Floodway Map (Exhibit 2), the floodway boundaries were determined at cross sections; between cross sections, the boundaries were interpolated. In cases where the boundaries of the floodway and the 100-year flood are either close together or collinear, only the floodway boundary has been shown.

The area between the floodway and the boundary of the 100-year flood is termed the floodway fringe. The floodway fringe thus encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 2.

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE ¹	WIDTH ² (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC.)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (NGVD)	INCREASE (FEET)
LITTLE MIAMI RIVER								
A	14.13	574	8715	9.8	531.7	531.7	532.7	1.0
B	14.35	376	7980	10.7	533.4	533.4	534.3	0.9
C	15.01	351	6793	12.5	537.3	537.3	538.2	0.9
D	15.58	1156	12,150	7.0	541.8	541.8	542.8	1.0
E	16.35	278	5655	14.9	545.1	545.1	546.0	0.9
F	17.01	617	11,627	7.3	552.1	552.1	552.8	0.7
G	17.84	255	6025	14.0	554.7	554.7	555.6	0.9
H	17.94	313	7069	11.9	556.7	556.7	557.7	1.0
I	18.15	313	7590	11.1	558.6	558.6	559.4	0.8
J	18.55	315	8428	10.0	560.4	560.4	561.1	0.7
K	19.95	331	8516	9.7	568.0	568.0	568.5	0.5
L	21.29	757	11,921	6.9	575.6	575.6	576.2	0.6
M	21.34	358	9902	8.4	575.7	575.7	576.3	0.6
N	21.54	420	11,348	7.3	578.0	578.0	578.9	0.9
O	22.17	338	8900	9.4	580.2	580.2	581.1	0.9
P	22.92	614	12,814	6.5	583.7	583.7	584.7	1.0

¹MILES ABOVE MOUTH²THESE WIDTHS EXTEND BEYOND COUNTY BOUNDARY

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLERMONT COUNTY, OH
 (UNINCORPORATED AREAS)

FLOODWAY DATA

LITTLE MIAMI RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC.)	REGULATORY (FEET NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
EAST FORK LITTLE MIAMI RIVER								
A	6.15	270	3919	5.8	526.9	526.9	527.8	0.9
B	6.25	205	3999	5.7	527.8	527.8	528.6	0.8
C	6.50	579	5694	4.0	529.1	529.1	529.9	0.8
D	7.00	405	4626	5.0	531.3	531.3	532.2	0.9
E	7.50	272	4265	5.4	534.2	534.2	534.9	0.7
F	8.13	810	7867	2.9	536.7	536.7	537.4	0.7
G	8.30	755	6746	3.4	537.2	537.2	537.9	0.7
H	8.65	387	3319	3.4	539.4	539.4	540.4	1.0
I	8.76	308	3393	3.3	539.4	539.9	540.8	0.9
J	9.10	228	2600	4.3	541.4	541.4	542.0	0.6
K	9.50	920	5526	2.0	543.3	543.3	544.0	0.7
L	10.20	246	2063	5.4	546.7	546.7	547.5	0.8
M	10.70	260	1890	5.9	551.9	551.9	551.9	0.4
N	11.20	178	2895	3.9	554.5	554.5	555.0	0.5
O	11.71	250	2954	3.8	556.2	556.2	556.8	0.6
P	12.30	202	1639	6.8	560.3	560.3	560.8	0.5
Q	12.70	216	2023	5.5	566.5	566.5	566.9	0.4
R	12.84	208 ²	1937	5.8	568.1	568.1	568.4	0.3
S	14.22	234 ²	2743	3.9	579.6	579.6	580.2	0.6
T	14.70	1238	3563	3.0	582.8	582.8	583.3	0.5
U	15.10	238	2337	4.5	586.4	586.4	586.5	0.1
V	15.25	217	2121	5.0	587.5	587.5	587.5	0.0
W	15.50	112	1265	8.4	590.2	590.2	591.0	0.8
X	15.95	234	2650	4.0	595.3	595.3	596.0	0.7
Y	16.20	496	3850	3.7	596.7	596.7	597.4	0.7
Z	16.40	186	2216	4.8	597.3	597.3	598.0	0.7

¹MILES ABOVE MOUTH

²TOTAL WIDTH/WIDTH WITHIN UNINCORPORATE AREA

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLERMONT COUNTY, OH
(UNINCORPORATED AREAS)

FLOODWAY DATA

EAST FORK LITTLE MIAMI RIVER

14

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC.)	REGULATORY (FEET NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
EAST FORK LITTLE MIAMI RIVER								
AA	16.90	156	2199	4.8	600.4	600.4	601.1	0.7
AB	17.48	244	1776	6.0	604.8	604.8	605.8	1.0
AC	32.90	390 ²	5495	4.2	803.8	803.8	804.8	1.0
AD	33.10	336 ²	5424	4.3	805.3	805.3	806.3	1.0
AE	33.18	282 ²	5274	4.4	807.3	807.3	807.9	0.6
AF	33.50	621	8705	2.7	808.2	808.2	808.9	0.7
AG	33.85	384 ²	5301	4.4	809.1	809.1	810.0	0.9
AH	33.98	231 ²	3238	7.1	810.1	810.1	811.0	0.9
AI	34.40	356	4849	4.8	815.0	815.0	815.7	0.7
AJ	34.90	520	6890	3.4	818.4	818.4	819.1	0.7
AK	35.20	815	10,354	2.2	818.9	818.9	819.6	0.7
AL	35.40	715	7331	3.2	819.2	819.2	820.0	0.8
AM	35.60	431	4906	4.7	819.8	819.8	820.6	0.8
AN	36.10	356	3957	5.8	822.9	822.9	823.7	0.8
AO	36.45	576	5636	4.1	825.3	825.3	826.2	0.9
AP	36.85	964	5312	4.3	827.3	827.3	828.2	0.9
AQ	37.15	300	3021	7.6	829.5	829.5	830.5	1.0
AR	37.40	217	3164	7.3	832.8	832.8	833.7	0.9

¹MILES ABOVE MOUTH²TOTAL WIDTH/WIDTH WITHIN UNINCORPORATED AREA

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLERMONT COUNTY, OH
(UNINCORPORATED AREAS)

FLOODWAY DATA

EAST FORK LITTLE MIAMI RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC.)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (NGVD)	INCREASE (FEET)
BULLSKIN CREEK								
A	1.25	430	2895	7.1	509.0	490.6 ²	491.6	1.0
B	1.50	357	2891	7.2	509.0	496.7 ²	497.6	0.9
C	2.00	441	4877	4.2	509.0	503.0 ²	503.8	0.8
D	2.45	372	2617	7.9	509.0	507.9 ²	508.5	0.6
E	2.81	400	1946	10.6	523.5	523.5	523.5	0.0
F	2.90	387	3671	5.6	529.0	529.0	529.0	0.0
G	3.10	598	3262	6.3	531.1	531.1	531.7	0.6
H	3.32	200	1801	11.5	536.9	536.9	537.3	0.4
I	3.36	270	2877	7.2	544.0	544.0	544.0	0.0
J	3.50	233	2036	10.2	546.5	546.5	547.1	0.6

¹MILES ABOVE MOUTH²ELEVATIONS WITHOUT CONSIDERING BACKWATER EFFECT FROM OHIO RIVER

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLERMONT COUNTY, OH
(UNINCORPORATED AREAS)

FLOODWAY DATA

BULLSKIN CREEK

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FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC.)	REGULATORY (FEET NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
STONELICK CREEK								
A	0.94	473	3714	5.6	544.6	544.6	545.5	0.9
B	0.99	394	5506	3.8	549.1	549.1	549.7	0.6
C	1.40	434	3910	5.3	551.5	551.5	552.4	0.9
D	2.15	249	2781	7.5	575.1	575.1	575.4	0.3
E	2.22	157	2249	9.3	576.6	576.6	576.7	0.1
F	2.40	279	3812	5.5	579.2	579.2	579.6	0.4
G	2.50	614	4720	4.4	580.6	580.6	581.1	0.5
H	2.90	634	4836	4.3	584.8	584.8	585.8	1.0
I	3.20	337	2259	9.3	589.8	589.8	590.0	0.2
J	3.36	422	3064	6.8	594.4	594.4	595.0	0.6
K	3.46	329	2844	7.3	596.6	596.6	597.2	0.6
L	3.80	246	2695	7.8	610.0	610.0	610.9	0.9
M	4.10	177	2130	9.8	617.4	617.4	618.3	0.9
N	4.50	212	2581	8.1	627.7	627.7	628.4	0.7
O	4.80	184	2150	9.7	634.7	634.7	635.3	0.6
P	5.19	138	1949	10.7	646.0	646.0	646.2	0.2
Q	5.24	220	2951	7.1	649.5	649.5	649.9	0.4
R	5.70	232	3362	6.2	654.7	654.7	655.3	0.6
S	6.10	135	1450	10.8	658.3	658.3	659.3	1.0
T	6.50	164	1326	11.8	674.1	674.1	674.5	0.4
U	6.80	209	1175	13.4	694.6	694.6	694.6	0.0
V	7.10	202	1725	9.1	713.3	713.3	713.4	0.1
TWELVEMILE CREEK								
A	1.29 ²	116/60 ³	1139	7.3	504.8	475.0 ⁵	475.5	0.5
B	1.73 ²	198 ⁴	1468	5.6	504.8	431.1 ⁵	483.5	0.4

¹MILES ABOVE CONFLUENCE WITH EAST FORK LITTLE MIAMI RIVER²MILES ABOVE MOUTH³TOTAL WIDTH/WIDTH WITHIN UNINCORPORATED AREAS⁴THIS WIDTH IS WITHIN VILLAGE OF NEW RICHMOND⁵ELEVATION WITHOUT CONSIDERING BACKWATER EFFECT FROM OHIO RIVER

REVISED: 8/6/85

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLERMONT COUNTY, OH
(UNINCORPORATED AREAS)

FLOODWAY DATA

12 STONELICK CREEK — TWELVEMILE CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC.)	REGULATORY (FEET NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
O'BANNON CREEK								
A	1.93	98	1338	10.3	613.5	613.5	613.6	0.1
B	1.96	114	1139	12.1	615.2	615.2	615.4	0.2
C	2.04	114	1268	10.9	618.2	618.2	618.3	0.1
D	2.12	114	1113	12.4	620.3	620.3	620.4	0.1
E	2.27	110	1042	13.2	626.4	626.4	626.5	0.1
F	2.53	108	1110	10.0	636.4	636.4	636.7	0.3
G	2.60	108	1060	10.5	637.9	637.9	638.1	0.2
H	2.63	111	1035	10.7	638.9	638.9	639.3	0.4
I	2.73	150	1233	9.0	642.4	642.4	642.6	0.2
J	2.76	121	1311	8.5	643.2	643.2	643.3	0.1
K	2.89	169	1094	10.1	645.9	645.9	646.2	0.3
L	3.16	124	921	12.1	658.3	658.3	658.4	0.1
M	3.21	108	757	14.7	660.3	660.3	660.3	0.0
N	3.24	119	1044	10.6	663.7	663.7	663.7	0.0
O	3.76	110	1121	9.1	679.5	679.5	679.8	0.3
P	4.59	82	1041	8.9	697.4	697.4	698.3	0.9
Q	4.61	85	1225	7.6	698.1	698.1	698.9	0.8
R	4.64	122	1372	6.7	699.2	699.2	699.9	0.7
S	4.80	140	1130	8.2	702.4	702.4	702.9	0.5
T	5.15	100	1050	8.8	713.4	713.4	714.0	0.6
U	5.67	134	1172	7.0	726.6	726.6	727.2	0.6
V	6.06	183	1632	5.0	732.5	732.5	733.1	0.6
W	6.10	176	1711	4.8	733.2	733.2	733.8	0.6
X	6.20	143	1215	6.7	734.2	734.2	734.7	0.5
Y	6.45	143	1081	7.6	740.6	740.6	741.2	0.6
Z	6.79	166	1340	6.1	749.5	749.5	750.2	0.7

¹MILES ABOVE MOUTH

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLERMONT COUNTY, OH
(UNINCORPORATED AREAS)

FLOODWAY DATA

O'BANNON CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC.)	REGULATORY (FEET NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
O'BANNON CREEK								
AA	6.83	110	1195	6.9	751.1	751.1	751.9	0.8
AB	6.93	110	1077	7.6	753.0	753.0	753.7	0.7
AC	7.41	81	830	9.9	766.9	766.9	767.5	0.6
AD	7.71	134	1437	5.7	773.9	773.9	774.8	0.9
AE	8.10	114	1111	5.0	778.7	778.7	779.5	0.8
AF	8.37	75	691	8.1	782.6	782.6	783.1	0.5
AG	8.41	101	833	6.7	784.4	784.4	785.0	0.6
AH	8.58	113	993	5.6	787.9	787.9	788.3	0.4
AI	8.62	94	795	7.0	788.7	788.7	788.8	0.1
AJ	8.69	104	827	6.8	790.3	790.3	790.5	0.2
AK	8.73	103	837	6.7	791.3	791.3	791.3	0.0
AL	9.54	129	890	5.8	811.7	811.7	812.6	0.9

¹MILES ABOVE MOUTH

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLERMONT COUNTY, OH
(UNINCORPORATED AREAS)

FLOODWAY DATA

O'BANNON CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION				
CROSS SECTION	DISTANCE'	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC.)	REGULATORY (FEET NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)	
RIGHT BANK TRIBUTARY TO O'BANNON CREEK									
	A	0.07	72	605	6.3	774.7	774.7	775.7	1.0
	B	0.34	71	605	6.3	780.2	780.2	781.2	1.0
	C	0.47	69	611	6.2	782.8	782.8	783.7	0.9
	D	0.49	69	632	6.0	783.2	783.2	784.1	0.9
	E	0.68	61	548	6.9	786.5	786.5	787.4	0.9
	F	0.74	41	334	4.8	788.2	788.2	789.0	0.8
	G	0.95	36	182	8.8	793.3	793.3	793.6	0.3
	H	0.97	36	231	6.9	794.8	794.8	795.1	0.3
	I	1.01	50	456	3.5	799.0	799.0	799.2	0.2
	J	1.14	47	391	4.1	799.7	799.7	799.9	0.2
	K	1.20	65	796	2.0	805.2	805.2	805.5	0.3
	L	1.28	67	627	2.5	805.3	805.3	805.6	0.3
	M	1.32	73	635	2.5	805.6	805.6	806.0	0.4

'MILES ABOVE MOUTH

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLERMONT COUNTY, OH

(UNINCORPORATED AREAS)

FLOODWAY DATA

RIGHT BANK TRIBUTARY TO O'BANNON CREEK

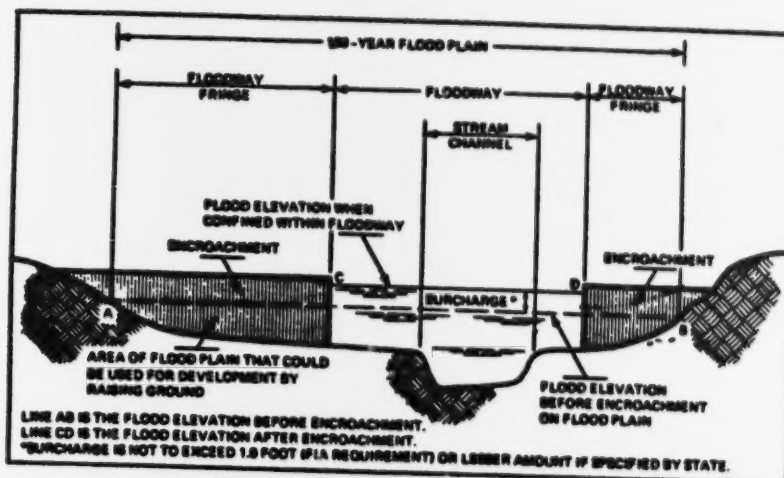


FIGURE 2 - Floodway Schematic

The floodways in this report are recommended to local agencies as minimum standards that can be adopted or that can be used as a basis for additional studies.

5.0 INSURANCE APPLICATION

In order to establish actuarial insurance rates, the FIA has developed a process to transform the data from the engineering study into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors (FHF), and flood insurance zone designations for each flooding source affecting the unincorporated areas of Clermont County.

5.1 Reach Determinations

Reaches are defined as lengths of watercourses having relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference does not have a variation greater than that indicated in the following table for more than 20 percent of the reach.

<u>Average Difference Between 10- and 100-year Floods</u>	<u>Variation</u>
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot
7.1 to 12 feet	2.0 feet
More than 12 feet	3.0 feet

The locations of the reaches determined for the unincorporated areas of Clermont County are shown on the Flood Profiles (Exhibit 1) and are summarized in the Flood Insurance Zone Data Table (Table 3).

5.2 Flood Hazard Factors

The FHF is used to correlate flood information with insurance rate tables. Correlations between property damage from floods and their FHF's are used to set actuarial insurance premium rate tables based on FHF's from 005 to 200.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations expressed to the nearest 0.5 foot, and shown as a three-digit code. For example, if the difference between water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year water-surface elevations is greater than 10.0 feet, accuracy for the FHF is to the nearest foot.

5.3 Flood Insurance Zones

After the determination of reaches and their respective FHF's, the unincorporated areas of Clermont County were divided into zones, each having a specific flood potential or hazard. Each zone was assigned one of the following flood insurance zone designations:

Zone A:

Special Flood Hazard Areas inundated by the 100-year flood, determined by approximate methods; no base flood elevations are shown or FHF's determined.

Zones A4-A7, A10, A12, A14, A22:

Special Flood Hazard Areas inundated by the 100-year flood, determined by detailed methods; base flood elevations are shown, and zones subdivided according to FHF.

Zone B:

Areas between the Special Flood Hazard Area and the limits of the 500-year flood, including areas of the 500-year flood plain that are protected from the 100-year flood by dike, levee, or other water control structure; or areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; and areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.

Zone C:

Areas of minimal flooding.

Table 3, "Flood Insurance Zone Data," summarizes the flood elevation differences, FHF's, flood insurance zones, and base flood elevations for each flooding source studied in detail in the community.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the unincorporated areas of Clermont County is, for insurance purposes, the principal result of the Flood Insurance Study. This map (published separately) contains the official delineation of flood insurance zones and base flood elevation lines. Base flood elevation lines show the locations of the expected whole-foot water-surface elevations of the base (100-year) flood. This map is developed in accordance with the latest flood insurance map preparation guidelines published by the FIA.

6.0 OTHER STUDIES

In 1964, the Division of Water of the ODNR published a report on the Little Miami River and Mill Creek Basins (Reference 22). Section 4.0 of this publication covers the flood problems of the Little Miami River and the East Fork Little Miami River, but does not present any flood profiles or flood data for specific locations in the county. The Little Miami River Conservancy District (LMRCD) was formed in 1933 to consider flooding problems in the valley. In 1966, the LMRCD published a preliminary engineering report which recommended a program of improvements to be considered in developing the official plan of the LMRCD (Reference 23). The report contains no flood profiles or specific hydrologic and hydraulic data pertinent to this study.

In 1966, the Louisville District COE prepared a flood plain information study for the Little Miami River in which the valley's flood problems and potential flood problems were presented (Reference 24). This report supersedes the COE report because the watershed has changed and locks and dams have been added since 1966. The 1966 study has been updated to reflect the effects of Caesar Creek Lake and East Fork Lake upon future floods on the Little Miami River (Reference 5). Results of the later COE study were compared with the 10-, 50-, 100-, and 500-year flood levels determined in this study and were found to be in total agreement. A Flood Plain Information Report, also prepared by the Louisville District, for the Ohio River in Clermont County, Ohio, was published in December 1968 (Reference 2).

A Flood Insurance Study for the Village of New Richmond has been published (Reference 11). The elevations for the Ohio River are not in agreement with this study, since the county study reflects more recent conditions. A Flood Insurance Study for the City of Loveland has been published (Reference 25). The elevations for the Little Miami River are not in agreement with this study since the Clermont County Study reflects more recent conditions, newer methods, more appropriate techniques and more refined data.

FLOODING SOURCE	PANEL ¹	ELEVATION DIFFERENCE ² BETWEEN 1.0% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION ³ (FEET NGVD)
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
OHIO RIVER REACH 1	0085,0105,0110, 0130,0135,0145, 0150,0160,0165, 0170	-11.2	-3.1	8.1	110	A21	VARIES—SEE MAP
LITTLE MIAMI RIVER							
REACH 1	0025,0045	- 4.9	-1.4	3.0	050	A10	VARIES—SEE MAP
REACH 2	0025	- 5.8	-1.6	3.9	060	A12	VARIES—SEE MAP
REACH 3	0005,0025	- 6.9	-2.0	5.2	070	A14	VARIES—SEE MAP
EAST FORK LITTLE MIAMI RIVER							
REACH 1	0050	-3.7	-1.1	2.2	035	A7	VARIES—SEE MAP
REACH 2	0050,0055,0070, 0075,0095	-2.1	-0.7	1.1	020	A4	VARIES—SEE MAP
REACH 3	0080	-2.8	-0.7	1.7	030	A6	VARIES—SEE MAP
REACH 4	0080	-2.5	-0.7	1.3	025	A5	VARIES—SEE MAP
REACH 5	0080	-1.8	-0.5	0.9	020	A4	VARIES—SEE MAP
BULLSKIN CREEK							
REACH 1	0170	- 2.5	-0.7	1.3	025	A5	VARIES—SEE MAP

¹FLOOD INSURANCE RATE MAP PANEL

²WEIGHTED AVERAGE

³ROUNDED TO NEAREST FOOT

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLERMONT COUNTY, OH
(UNINCORPORATED AREAS)

FLOOD INSURANCE ZONE DATA

OHIO RIVER — LITTLE MIAMI RIVER — EAST FORK LITTLE MIAMI RIVER —
BULLSKIN CREEK

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FLOODING SOURCE	PANEL ¹	ELEVATION DIFFERENCE ² BETWEEN 1.0% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION ³ (FEET NGVD)
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
STONELICK CREEK							
REACH 1	0050,0055	-2.9	-0.9	1.2	030	A6	VARIABLES—SEE MAP
REACH 2	0050,0055	-3.8	-1.1	1.7	040	A8	VARIABLES—SEE MAP
REACH 3	0050,0055	-2.2	-0.8	0.9	020	A4	VARIABLES—SEE MAP
REACH 4	0055	-3.3	-0.9	1.1	035	A7	VARIABLES—SEE MAP
REACH 5	0055	-4.7	-1.2	1.2	045	A9	VARIABLES—SEE MAP
REACH 6	0055	-2.9	-0.7	1.0	030	A6	VARIABLES—SEE MAP
O'BANNON CREEK							
REACH 1	0010,0015	-3.0	N/A	N/A	030	A6	VARIABLES—SEE MAP
RIGHT BANK TRIBUTARY TO O'BANNON CREEK							
REACH 1	0015	-3.0	N/A	N/A	030	A6	VARIABLES—SEE MAP

¹FLOOD INSURANCE RATE MAP PANEL²WEIGHTED AVERAGE³ROUNDED TO NEAREST FOOT

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLERMONT COUNTY, OH
(UNINCORPORATED AREAS)

FLOOD INSURANCE ZONE DATA

STONELICK CREEK —
O'BANNON CREEK — RIGHT BANK TRIBUTARY TO O'BANNON CREEK

Flood Insurance Studies for the Village of Milford, Hamilton County; the Villages of Williamsburg, Chilo, Batavia, Moscow, Neville, Clermont County; and, Warren County, Unincorporated Areas, are in agreement with this study (References 12, 26, 27, 28, 29, 30, and 31). The Little Miami River portion of this study is contiguous with the Hamilton County, Unincorporated Areas, Flood Insurance Study (Reference 32). This study agrees exactly with the Hamilton County Flood Insurance Study.

A Flood Hazard Boundary Map has been published by the Federal Insurance Administration (Reference 21). The differences between the Flood Hazard Boundary Map and this study are justified due to the more detailed nature of this Flood Insurance Study.

This report either supersedes or is compatible with all previous studies published on streams studied in this report and should be considered authoritative for the purposes of the National Flood Insurance Program.

7.0 LOCATION OF DATA

Information concerning the pertinent data used in preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, Federal Emergency Management Agency, 300 South Wacker Drive, Chicago, Illinois 60606.

8.0 REFERENCES AND BIBLIOGRAPHY

1. Clermont County Planning Commission, Comprehensive Housing Element for Clermont County, Ohio, June 1977.
2. U.S. Army Corps of Engineers, Louisville District, Flood Plain Information, Ohio River, Clermont County, Ohio, December 1968.
3. Ohio Department of Natural Resources, Division of Water, Bulletin No. 45, Floods in Ohio, Magnitude and Frequency, 1977.
4. U.S. Department of Agriculture, Soil Conservation Service, Soil Survey of Clermont County, Ohio, September 1975.
5. U.S. Army Corps of Engineers, Louisville District, Flood Plain Information, Little Miami River, Hamilton, Clermont, and Warren Counties, Ohio, March 1977.
6. Clermont Sun, February 25, 1937.
7. U.S. Army Corps of Engineers, Louisville District, Basic Hydrologic Data on East Fork Little Miami River, unpublished data.
8. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Code of Federal Regulations, Title 24, Chapter 10, Parts 1910.3A and 3B, Federal Register, Volume 41, No. 207, revised 1976.
9. U.S. Army Corps of Engineers, Louisville District, Basic Cross Section and Hydrologic Data on the Ohio River, unpublished data.

10. U.S. Water Resources Council, Hydrology Committee, Bulletin No. 17, Guidelines for Determining Flood Flow Frequency, March 1976.
11. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Insurance Study, Village of New Richmond, Ohio, November 1980.
12. Federal Emergency Management Agency, Flood Insurance Study, Village of Milford, Hamilton County, Ohio, January 1981.
13. U.S. Army Corps of Engineers, Louisville District, Basic Cross Section and Hydrologic Data on Little Miami River, unpublished data.
14. Woolpert Consultants, Aerial Photographs, Scale 1:9600, 1978.
15. Ohio Department of Natural Resources, Division of Water, Milford to Fayetteville Area, January 1959 Flood Profile, East Fork of Little Miami River, October 1959.
16. U.S. Army Corps of Engineers, Hydrologic Engineering Center, Computer Program 723-X6-L202A, HEC-2 Water-Surface Profiles, Davis, California, December 1968 with updates.
17. Ohio Department of Natural Resources, Division of Water, Bulletin No. 32, Floods in Ohio, Magnitude and Frequency, 1959.
18. ———, Bulletin No. 43, Floods in Ohio, Magnitude and Frequency, A Supplement to Bulletin 32, 1969.
19. U.S. Geological Survey, 7.5 Minute Series Topographic Map, Scale 1:24000, Contour Interval 10 Feet, 1975.
20. Metropolitan Area Topographic Maps, Scale 1:2400, Contour Interval 5 Feet: Cincinnati, Ohio, 1958.
21. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Hazard Boundary Map, Clermont County, Unincorporated Areas, Ohio, December 1977.
22. Ohio Department of Natural Resources, Division of Water, Water Inventory of the Little Miami River and Mill Creek Basins, 1964.
23. Little Miami Conservancy District, Preliminary Engineering Report, 1966.
24. U.S. Army Corps of Engineers, Louisville District, Flood Plain Information Study, Little Miami River, Ohio, December 1966.
25. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Insurance Study, City of Loveland, Clermont County, Ohio, September 1978.

26. Federal Emergency Management Agency, Federal Insurance Administration, Flood Insurance Study, Village of Williamsburg, Clermont County, Ohio, February 1981.
27. ———, Federal Insurance Administration, Flood Insurance Study, Village of Chilo, Clermont County, Ohio, January 1981.
28. ———, Federal Insurance Administration, Flood Insurance Study, Village of Batavia, Clermont County, Ohio, February 1981.
29. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Insurance Study, Village of Moscow, Clermont County, Ohio, March 1977.
30. ———, Flood Insurance Study, Village of Neville, Clermont County, Ohio, September 1978.
31. Federal Emergency Management Agency, Federal Insurance Administration, Flood Insurance Study, Warren County, Unincorporated Areas, Ohio, April 1981.
32. ——— Flood Insurance Study, Hamilton County, Unincorporated Areas, Ohio, June 1982.

U.S. Army Corps of Engineers, Louisville District, Flood Plain Information, Ohio River, Hamilton County, Ohio, December 1968.

9.0 REVISIONS DESCRIPTION

This section has been added to provide information regarding significant revisions made since the original Flood Insurance Study was printed. Future revisions may be made that do not result in the republishing of the Flood Insurance Study report. To assure that any user is aware of all revisions, it is advisable to contact the community repository of flood hazard data located at the County Planning Commission Department, County Courthouse Building, 76 South Riverside, Batavia, Ohio.

9.1 First Revision (Revised August 5, 1985)

a. Purpose

The purpose of this Flood Insurance Study revision is to incorporate revised data into this currently effective Flood Insurance Study for Clermont County, Unincorporated Areas, Ohio. This revision is intended to provide updated information that aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

b. Acknowledgments

The hydrologic and hydraulic analyses for this revision were obtained from the U.S. Army Corps of Engineers (COE), Louisville District,

Flood Plain Information Report (Reference 33). The Federal Emergency Management Agency reviewed and accepted these data for purposes of this revision.

c. Scope

The entire length of O'Bannon Creek and Right Bank Tributary to O'Bannon Creek was revised as a result of a Flood Plain Information Report prepared by the COE, Louisville District (Reference 33). O'Bannon Creek was revised from its confluence with the Little Miami River to about 12 miles upstream. Right Bank Tributary to O'Bannon Creek was revised from its confluence with O'Bannon Creek to about 3 miles upstream.

East Fork Little Miami River was restudied from just downstream of Round Bottom Road to about 2.3 miles upstream of State Route 222, and from just downstream of State Route 133 to about 1.8 miles upstream of State Route 32. Stonelick Creek was restudied from its confluence with East Fork Little Miami River to about 1.4 miles upstream of Titus Road.

d. Hydrologic and Hydraulic Analyses

The discharges for East Fork Little Miami River have been updated by the COE, Louisville District, to reflect the effects of East Fork Lake Dam.

The hydrology of O'Bannon Creek was only studied with respect to the 100-year level. These discharges are summarized in Table 4, Revised Summary of Discharges.

The zone designations for Right Bank Tributary to O'Bannon Creek and for O'Bannon Creek are based on comparisons with adjacent streams having similar flooding characteristics.

TABLE 4 - REVISED SUMMARY OF DISCHARGES

<u>FLOODING SOURCE AND LOCATION</u>	<u>DRAINAGE AREA (SQ MILES)</u>	<u>PEAK DISCHARGE (CFS)</u>			
		<u>10-YEAR</u>	<u>50-YEAR</u>	<u>100-YEAR</u>	<u>500-YEAR</u>
O'BANNON CREEK at confluence with the Little Miami River	N/A	N/A	N/A	14,300	N/A
RIGHT BANK TRIBUTARY TO O'BANNON CREEK at its confluence with O'Bannon Creek	N/A	N/A	N/A	3,800	N/A

TABLE 4 - REVISED SUMMARY OF DISCHARGES (Continued)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQ MILES)	PEAK DISCHARGE (CFS)			
		10-YEAR	50-YEAR	100-YEAR	500-YEAR
EAST FORK LITTLE MIAMI RIVER at Round Bottom Road Bridge (USGS Gage)	476	14,700	20,300	22,900	29,400
just upstream of confluence of Stonelick Creek	380	8,000	10,060	11,180	13,570
at State Route 32 Bridge in Batavia	359	7,540	9,500	10,560	12,820
at State Route 32 Bridge at Williamsburg (USGS gage)	237	16,600	21,200	23,100	26,500

Additional HEC-2 hydraulic analyses were provided for O'Bannon Creek and Right Bank Tributary to O'Bannon Creek. Hydraulic analyses were only done for the 100-year discharge. Profiles and flooding boundaries derived from these analyses were incorporated into the Flood Insurance Rate Map and the Flood Boundary and Floodway Map.

The hydraulic reanalyses for East Fork Little Miami River and Stonelick Creek were performed using the original HEC-2 models with revisions to the cross-section data and channel geometry, wherever appropriate.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles. For stream segments for which a floodway was computed, selected cross-section locations are also shown on the Flood Boundary and Floodway Map.

Roughness factors (Manning's "n") used in the hydraulic computations were chosen by engineering judgment and based on field observations of the streams and flood plain areas. Roughness values for the main channel of O'Bannon Creek ranged from 0.045 to 0.055, while flood plain roughness values ranged from 0.050 to 0.080 for all floods. The roughness value for the main channel of Right Bank Tributary to O'Bannon Creek was 0.055 while the flood plain roughness value was 0.070 for all floods.

Water-surface elevations of floods of the selected recurrence intervals were computed through use of the COE HEC-2 step-backwater computer program (Reference 34). This computer model was calibrated using historic floodwater profiles.

Flood profiles were drawn showing the computed water-surface elevations for floods of the selected recurrence intervals. Starting water-surface elevations for O'Bannon Creek and Right Bank Tributary to O'Bannon Creek were calculated using the slope-area method.

All elevations are referenced to the National Geodetic Vertical Datum of 1929. Elevation reference marks used in the study are shown on the maps.

The hydraulic analyses for this study are based on the effects of unobstructed flow. The flood elevations shown on the profiles are, thus, considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

e. Floodways

Floodway computations for the waterways discussed in this revision were revised as a result of the new hydraulic computations.

The floodways for East Fork Little Miami River, Stonelick Creek, O'Bannon Creek, and Right Bank Tributary to O'Bannon Creek were computed on the basis of equal conveyance reduction from each side of the flood plain. The results of these computations are tabulated at selected cross sections for each segment for which a floodway was computed and are presented in Table 2, Floodway Data.

f. Other Studies

A Flood Insurance Study for Warren County, Unincorporated Areas, Ohio has been published (Reference 35). The flood plain delineation and zone designation for O'Bannon Creek does not agree with this study since the Clermont County study incorporates a more recent hydraulic analysis.

g. References and Bibliography

33. U.S. Army Corps of Engineers, Louisville District, Flood Plain Information, O'Bannon Creek, Clermont County, Ohio, June 1982.
34. ———, Hydrologic Engineering Center, HEC-2 Water Surface Profiles, Computer Program 723-X6-L202A, Davis, California, April 1984.

35. Federal Emergency Management Agency, Federal Insurance Administration, Flood Insurance Study, Warren County, Unincorporated Areas, Ohio, April 1981.

U.S. Army Corps of Engineers, Louisville District, Flood Plain Information, Ohio River, Hamilton County, Ohio, December 1968.

9.2 Second Revision (Revised September 29, 1989)

a. Acknowledgments

The hydrologic and hydraulic analyses for this Revisions Description were performed by the U.S. Army Corps of Engineers (COE), Ohio River Division. The Federal Emergency Management Agency reviewed and accepted these data for purposes of this revision.

b. Scope

The base flood elevations and the flood insurance zone designations along the Ohio River, which flows along the southwestern Clermont County boundary and forms the Ohio-Kentucky State line, were revised based on a report published by the COE titled, "Profiles on the Ohio River" (Reference 36).

Additionally, the flood insurance zone designation for Twelvemile Creek was revised for the area affected by the Ohio River backwater and the base flood elevation for Bullskin Creek was revised to reflect a lower backwater elevation from the Ohio River and is shown in Table 2, Floodway Data.

c. Other Studies

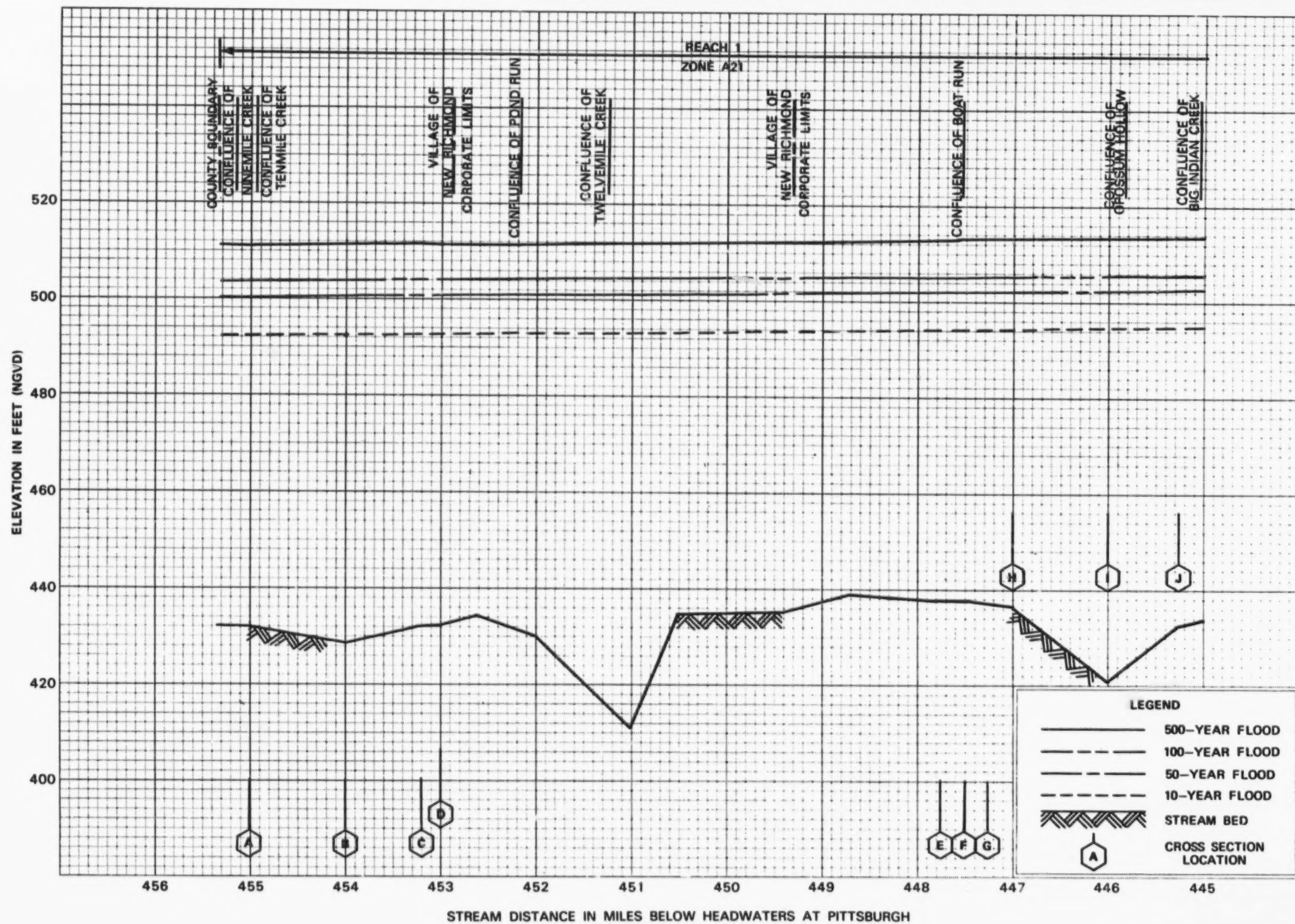
The Flood Insurance Study published for the Village of Chilo, Clermont County, Ohio (Reference 37) is being revised in conjunction with this revised study and is in agreement.

Flood Insurance Studies have been published for the Villages of Neville, Moscow, and New Richmond, Ohio (References 38-40); for the City of California, Kentucky (Reference 41); for Campbell County, Kentucky (Reference 42); and for Hamilton County, Ohio (Reference 43). The base flood elevations on the reaches of the Ohio River in those Flood Insurance Studies do not agree with this revised Flood Insurance Study because this revision incorporates more recent data. Those studies will be updated in the future to incorporate the more recent data for the Ohio River.

d. References and Bibliography

36. U.S. Army Corps of Engineers, Ohio River Division, Profiles on the Ohio River, revised March 1983.

37. Federal Emergency Management Agency, Federal Insurance Administration, Flood Insurance Study, Village of Chilo, Clermont County, Ohio, January 1981, revision in progress.
38. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Insurance Study, Village of Neville, Clermont County, Ohio, September 1978.
39. ———, Federal Insurance Administration, Flood Insurance Study, Village of Moscow, Clermont County, Ohio, March 1977.
40. Federal Emergency Management Agency, Federal Insurance Administration, Flood Insurance Study, Village of New Richmond, Clermont County, Ohio, November 1980.
41. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Insurance Study, City of California, Campbell County, Kentucky, April 1978.
42. Federal Emergency Management Agency, Flood Insurance Study, Campbell County, Unincorporated Areas, Kentucky, September 1981.
43. —————, Flood Insurance Study, Hamilton County, Unincorporated Areas, Ohio, June 1982.



FLOOD PROFILES

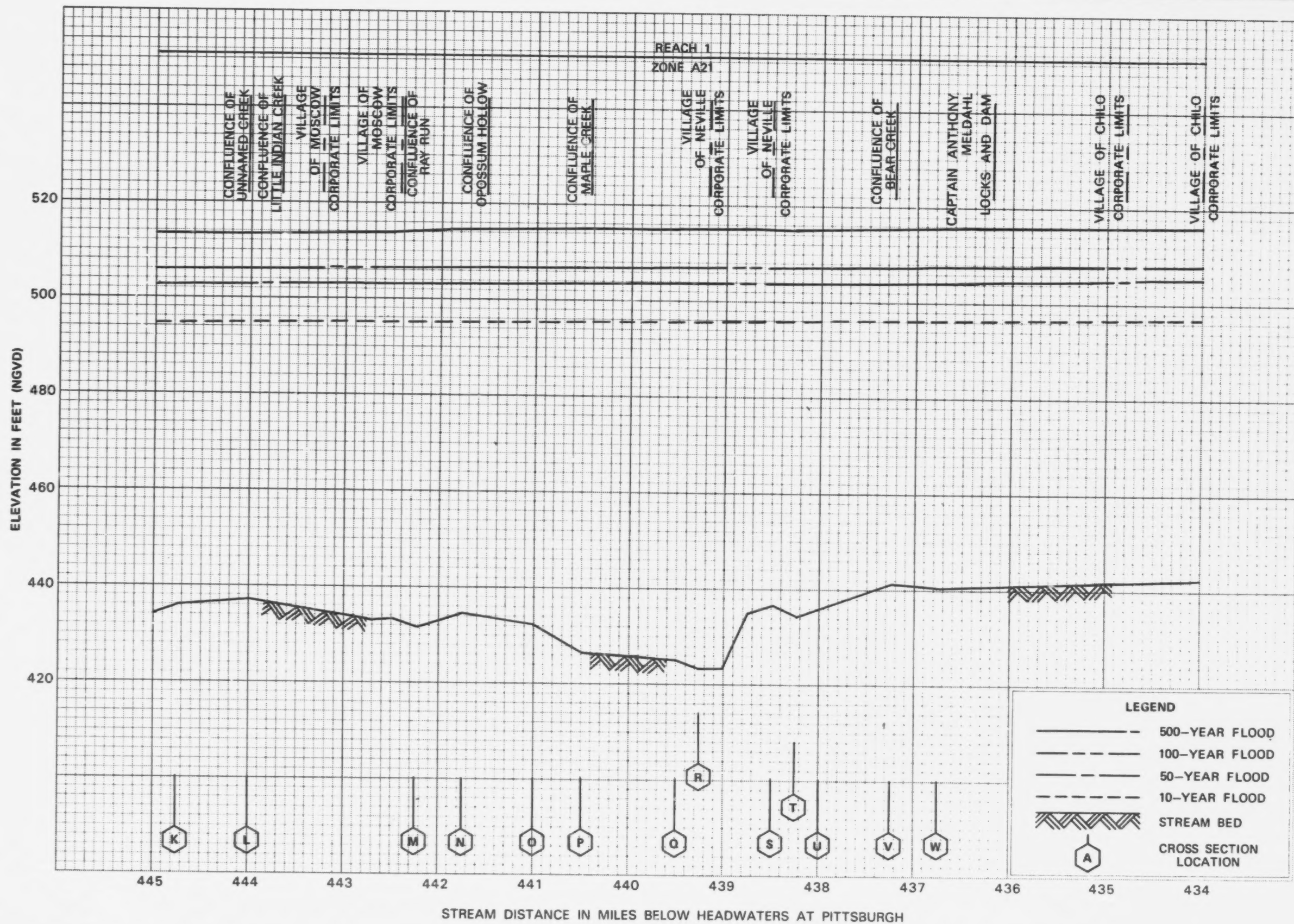
OHIO RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLERMONT COUNTY, OH
(UNINCORPORATED AREAS)

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FLOOD PROFILES

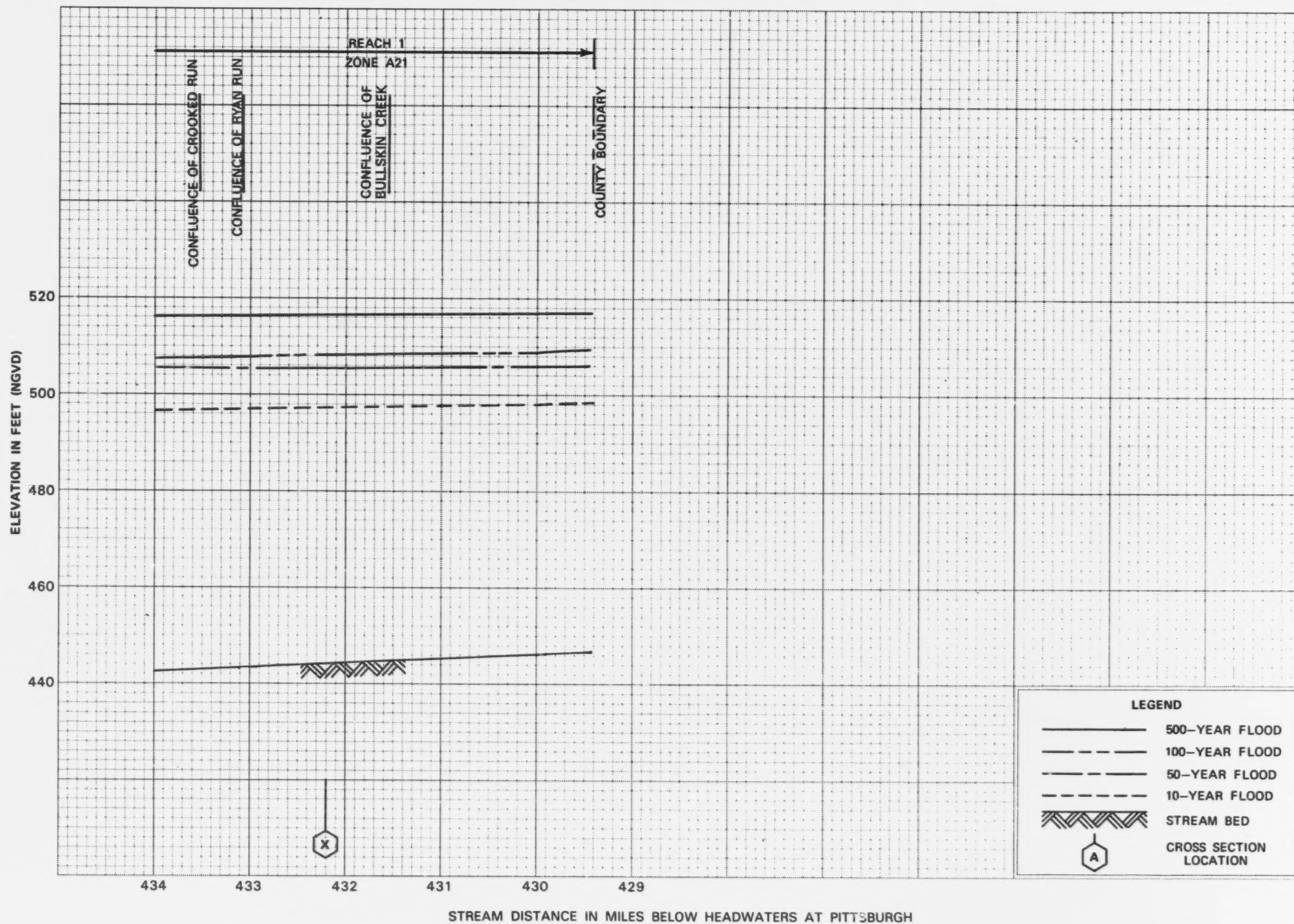
OHIO RIVER

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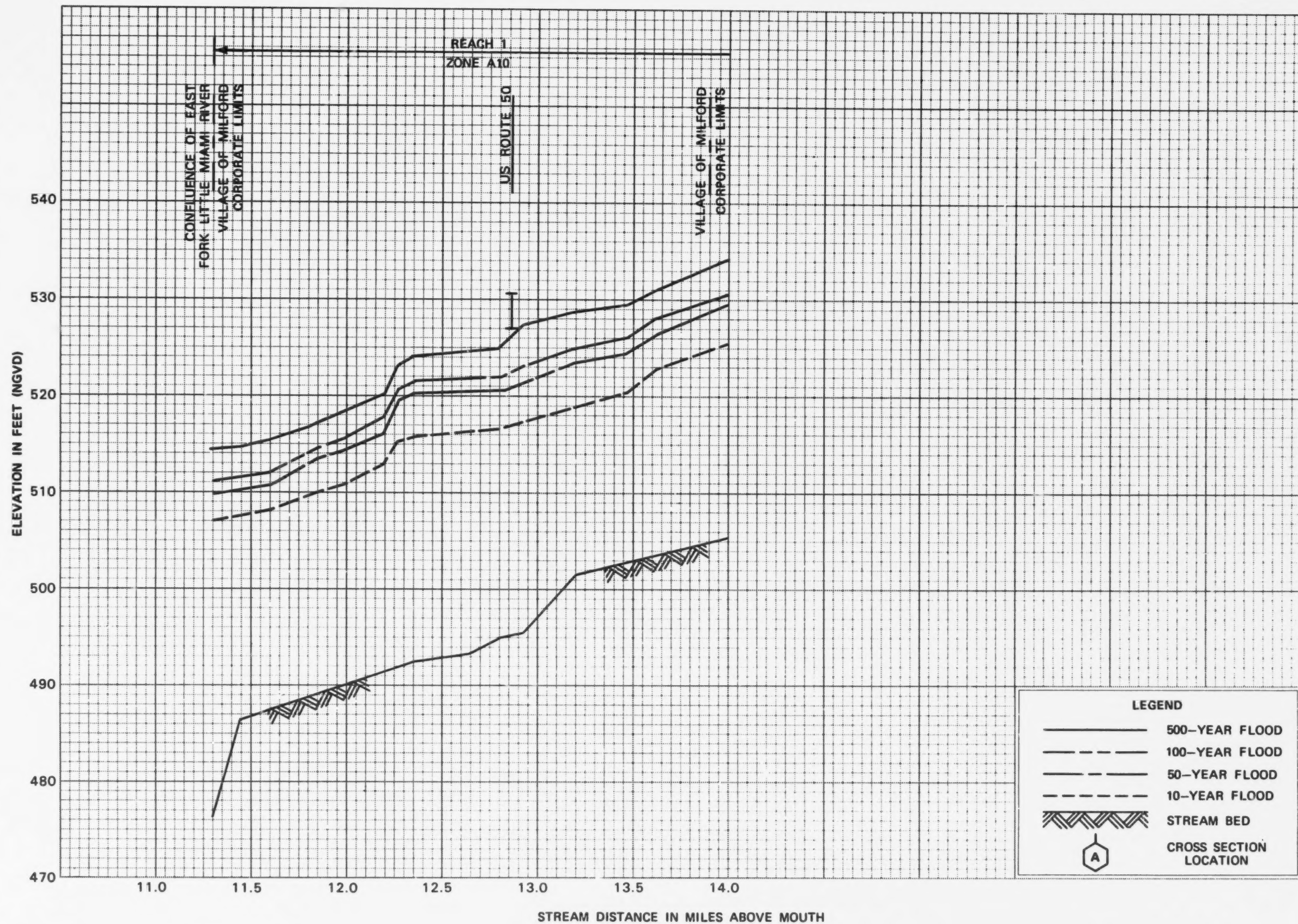
FLOOD PROFILES

OHIO RIVER

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(UNINCORPORATED AREAS)

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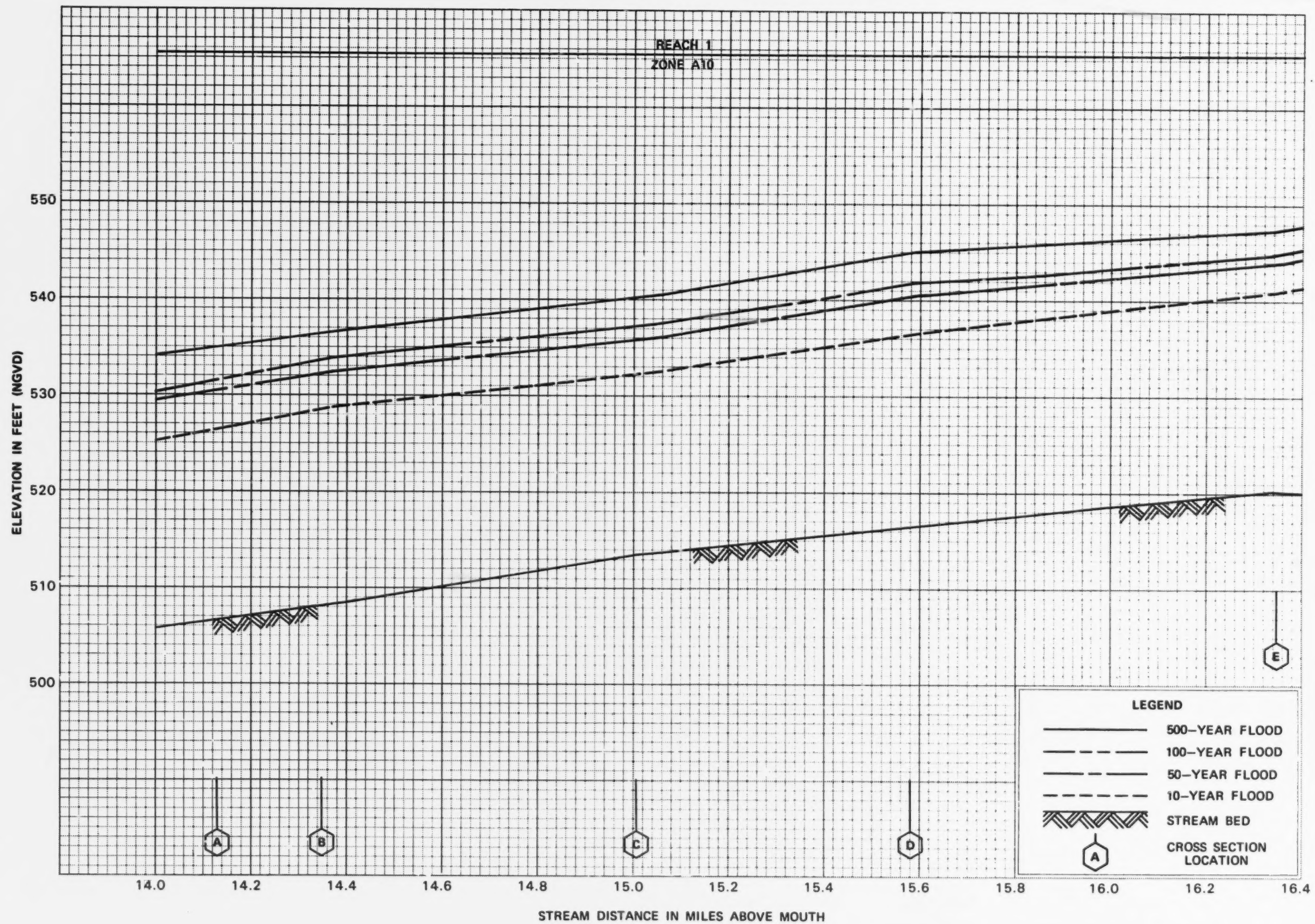
FLOOD PROFILES

LITTLE MIAMI RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLERMONT COUNTY, OH
(UNINCORPORATED AREAS)

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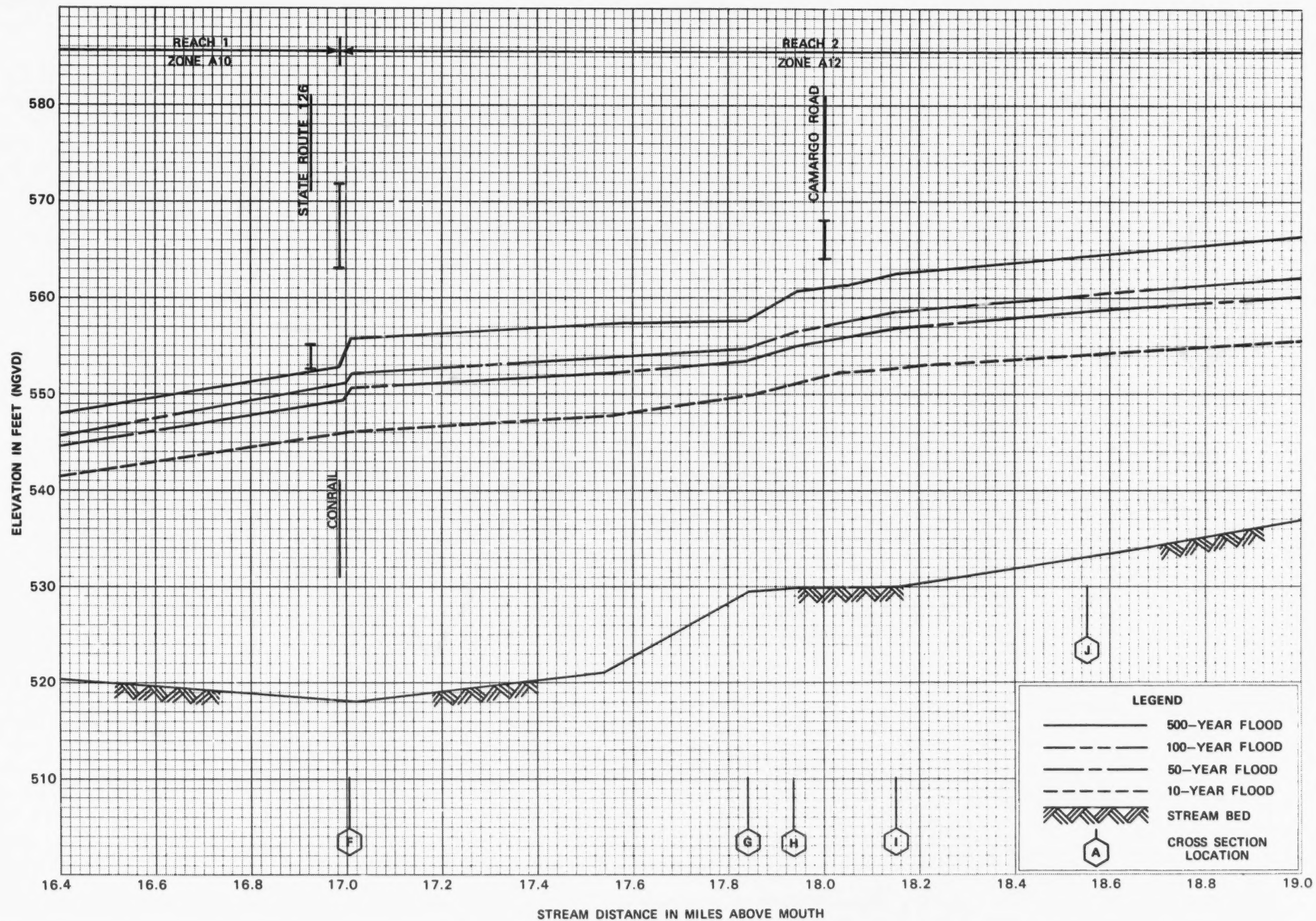
FLOOD PROFILES

LITTLE MIAMI RIVER

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CLERMONT COUNTY, OH
(UNINCORPORATED AREAS)

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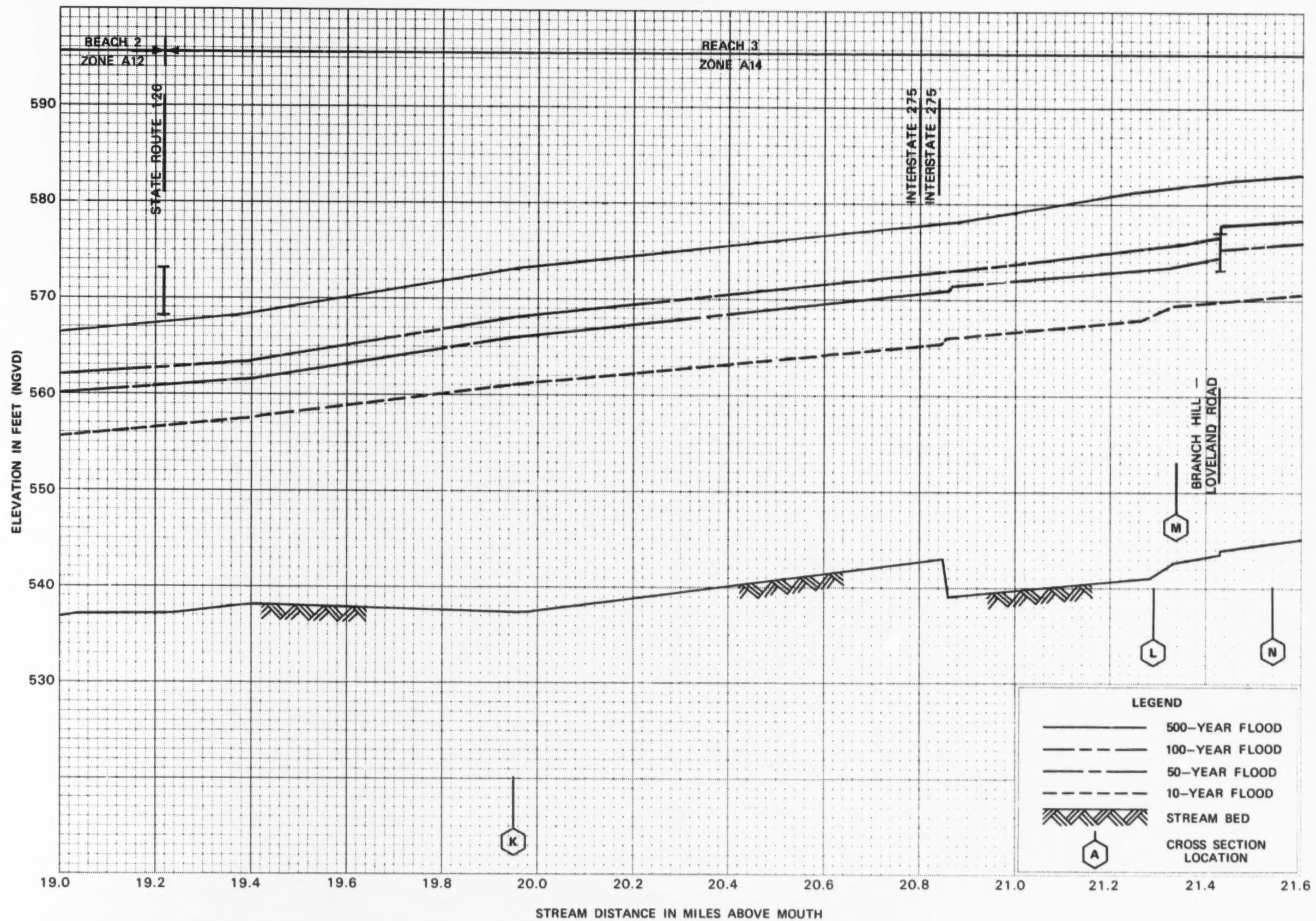


FLOOD PROFILES

LITTLE MIAMI RIVER

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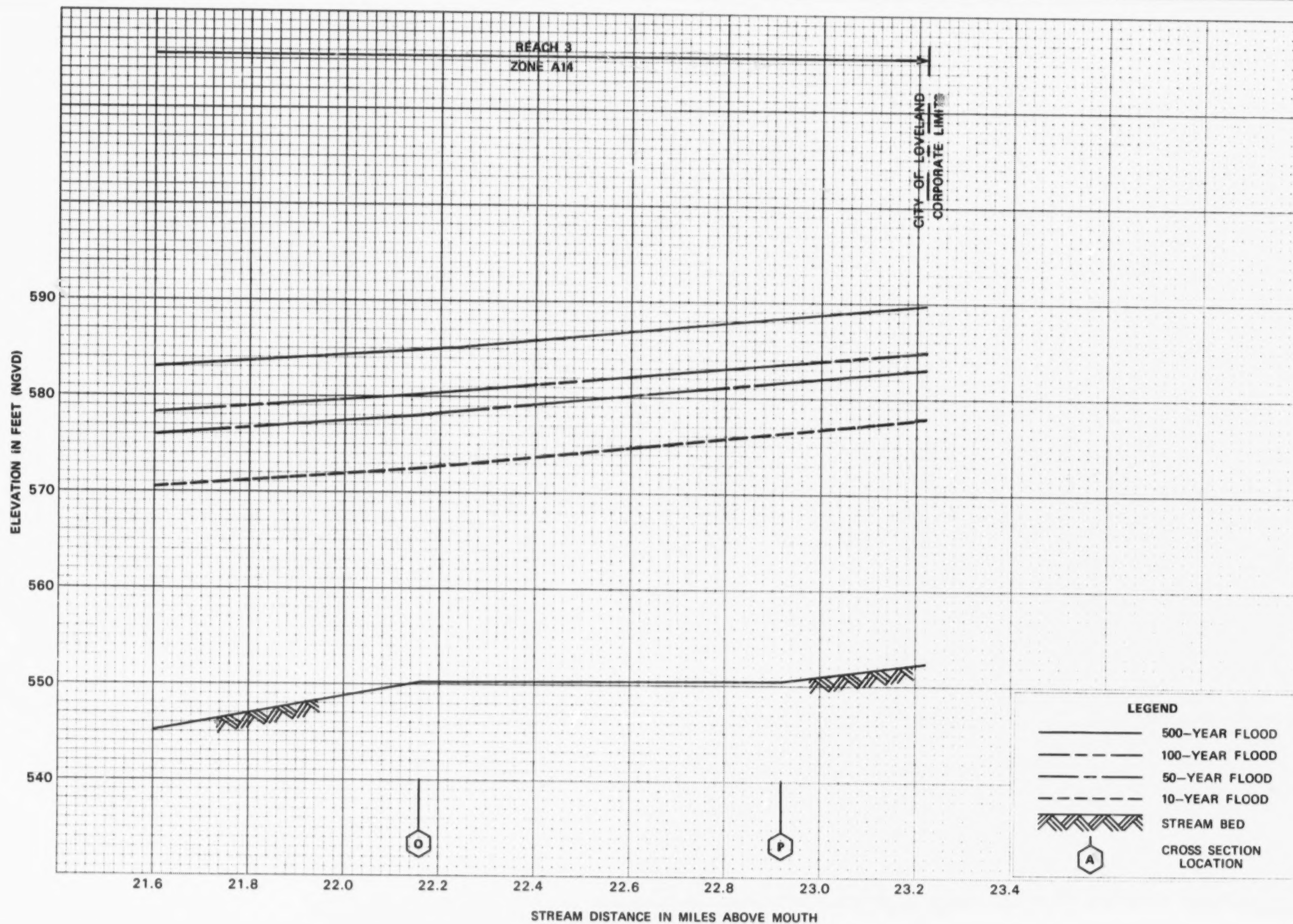
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FLOOD PROFILES
LITTLE MIAMI RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY
CLERMONT COUNTY, OH
(UNINCORPORATED AREAS)

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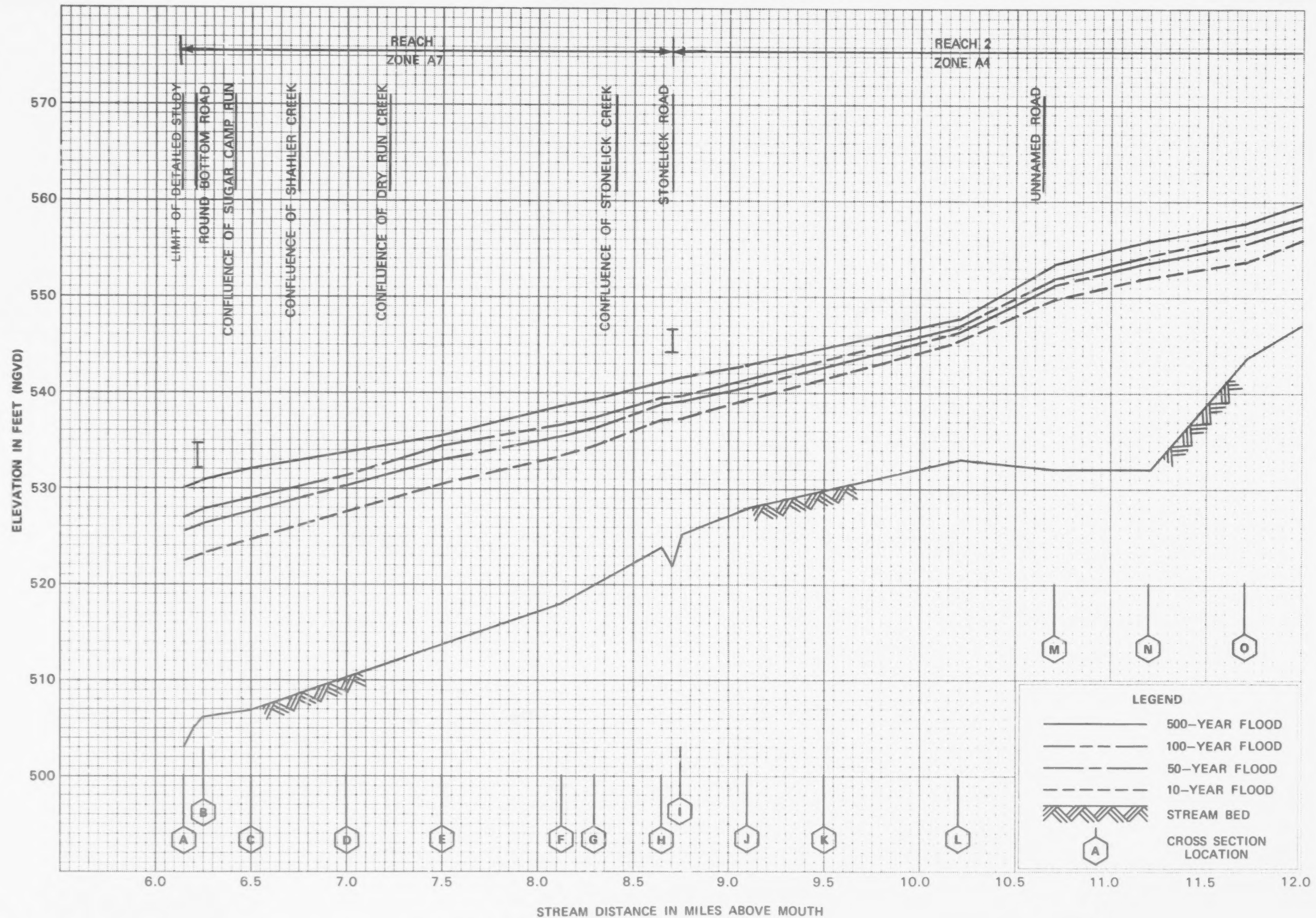
FLOOD PROFILES

LITTLE MIAMI RIVER

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CLERMONT COUNTY, OH
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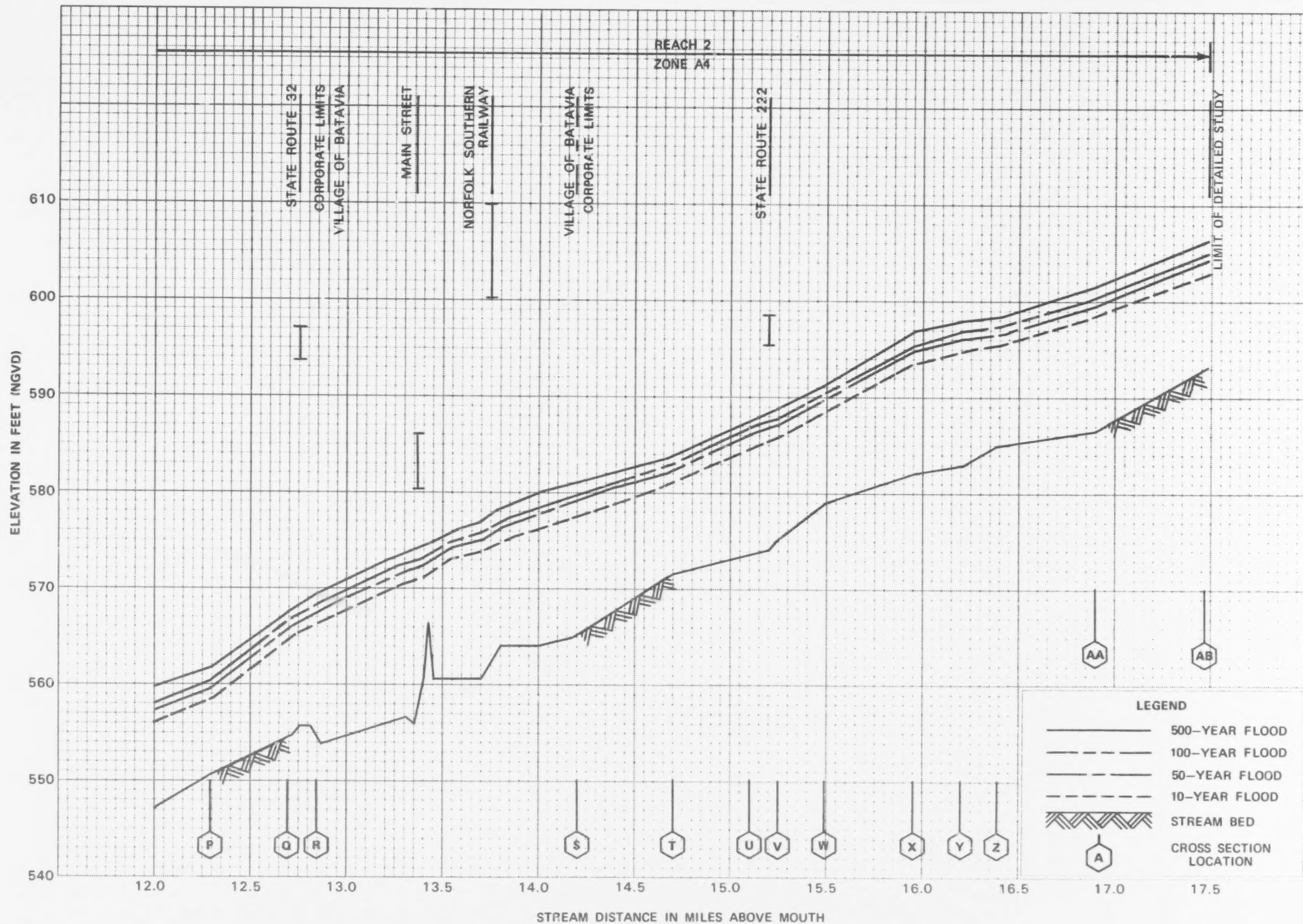


FLOOD PROFILES

EAST FORK LITTLE MIAMI RIVER

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CLERMONT COUNTY, OH
 (UNINCORPORATED AREAS)

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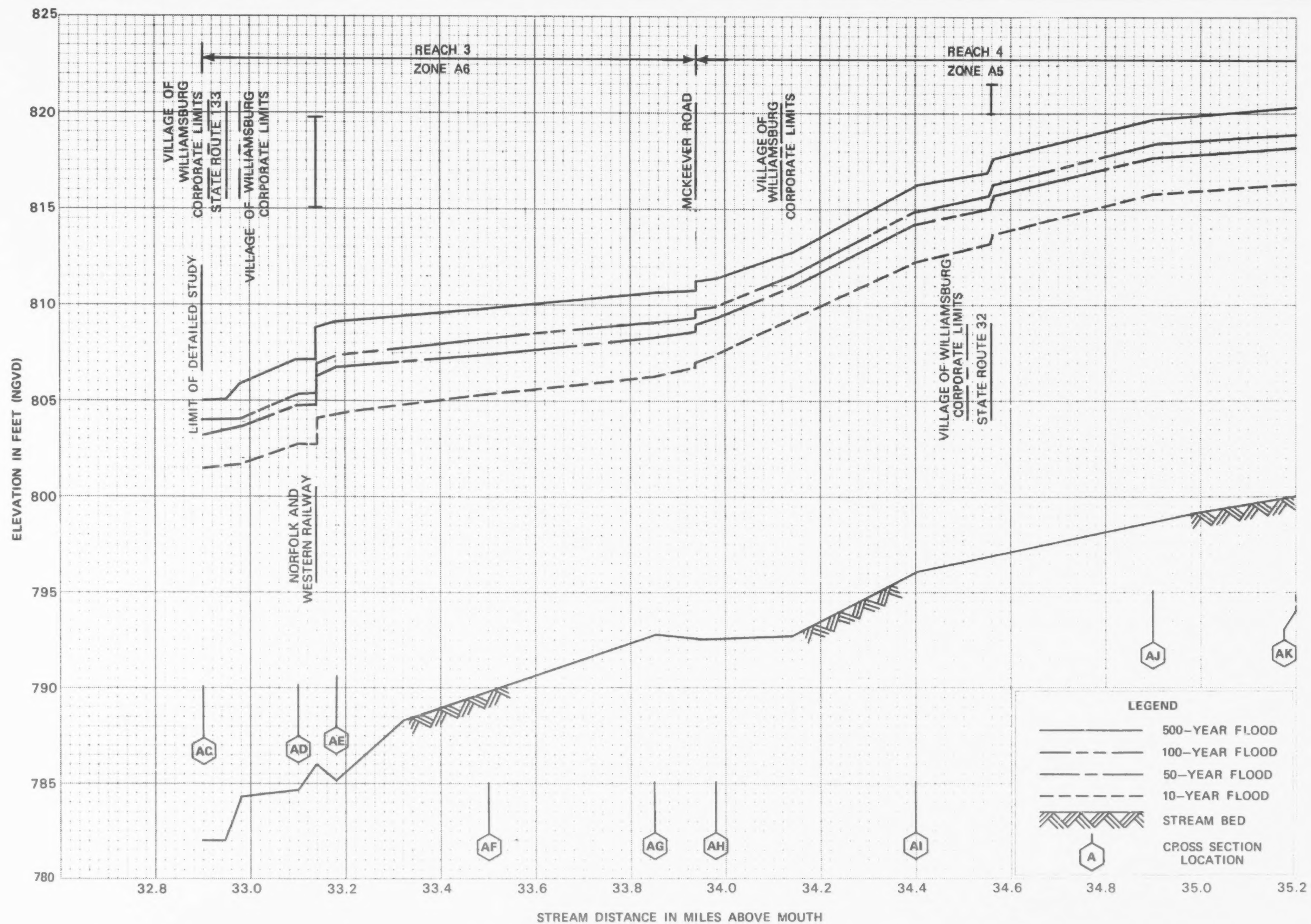
FLOOD PROFILES

EAST FORK LITTLE MIAMI RIVER

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CLERMONT COUNTY, OH
(UNINCORPORATED AREAS)

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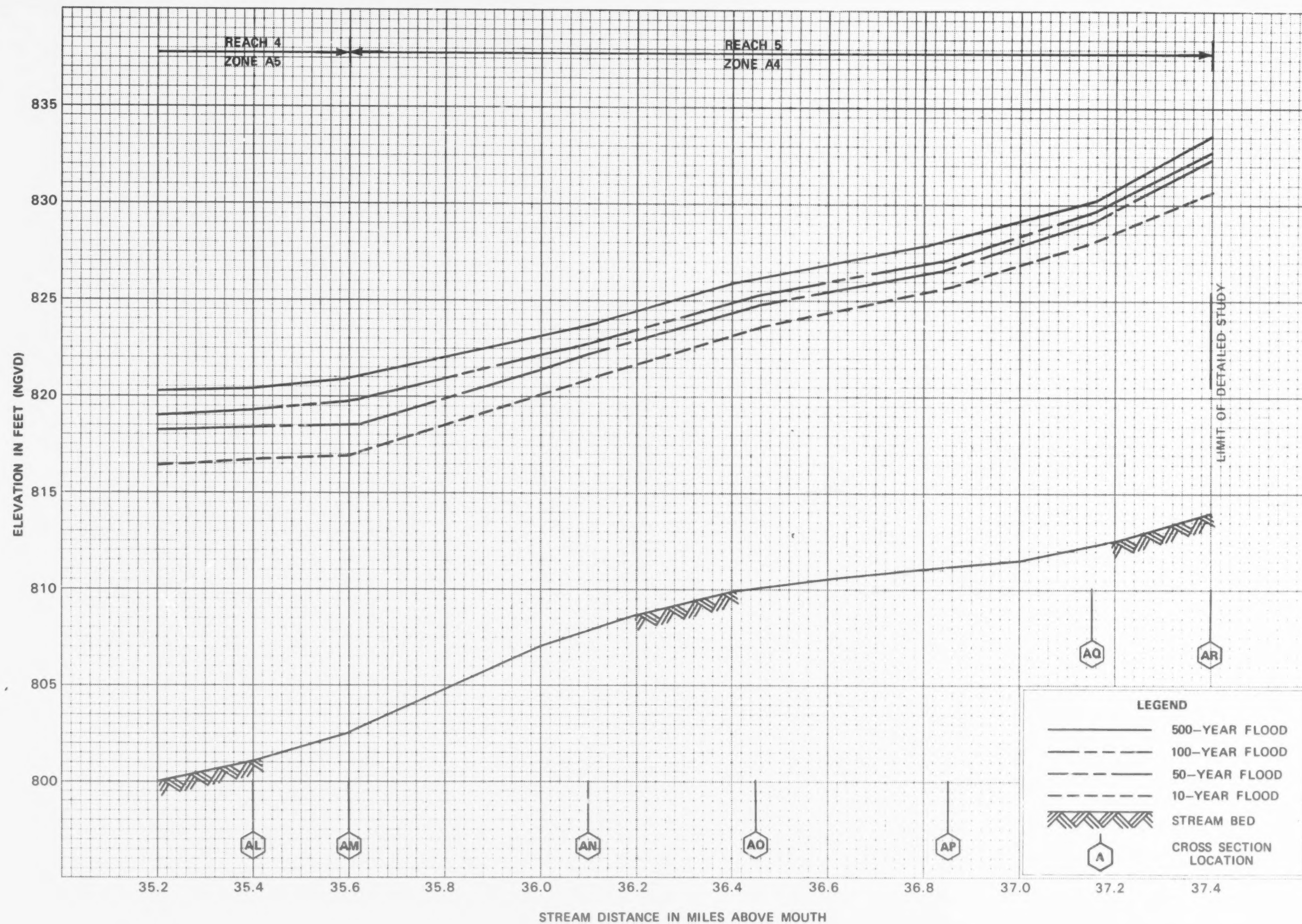
FLOOD PROFILES

EAST FORK LITTLE MIAMI RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLERMONT COUNTY, OH
(UNINCORPORATED AREAS)

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FLOOD PROFILES

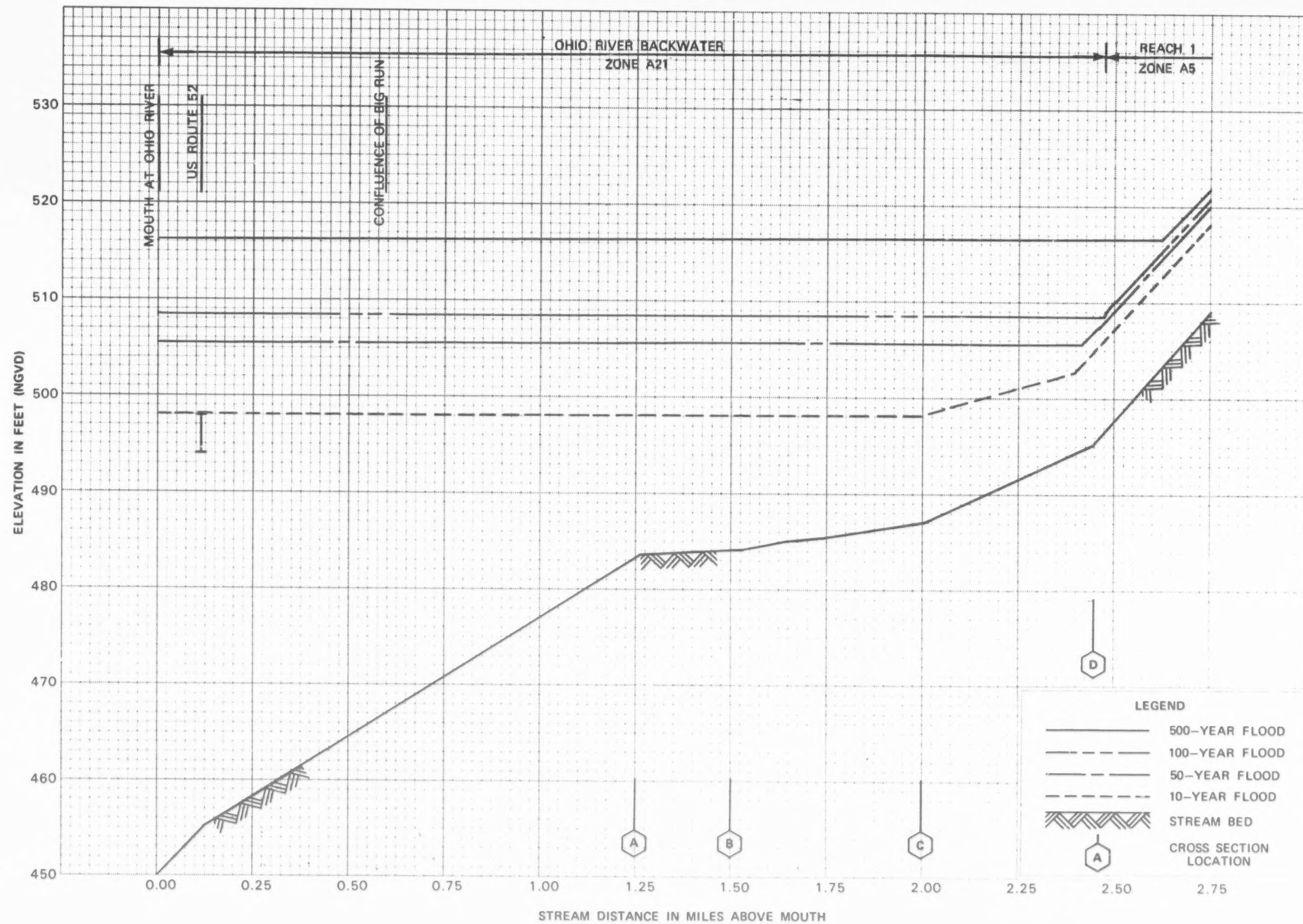
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FEDERAL EMERGENCY MANAGEMENT AGENCY

CLERMONT COUNTY, OH
(UNINCORPORATED AREAS)

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FLOOD PROFILES

BULLSKIN CREEK

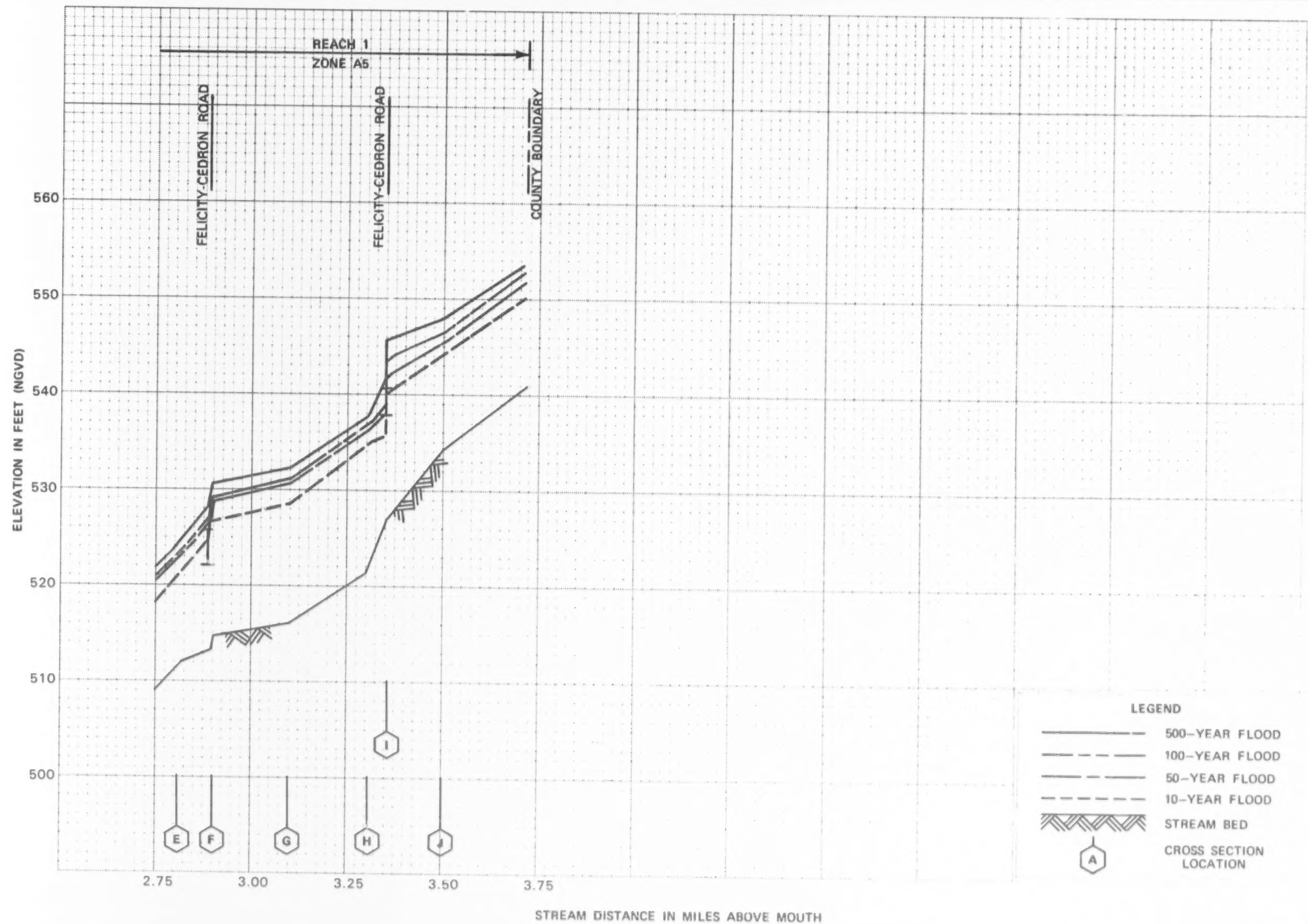
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CLERMONT COUNTY, OH
(UNINCORPORATED AREAS)

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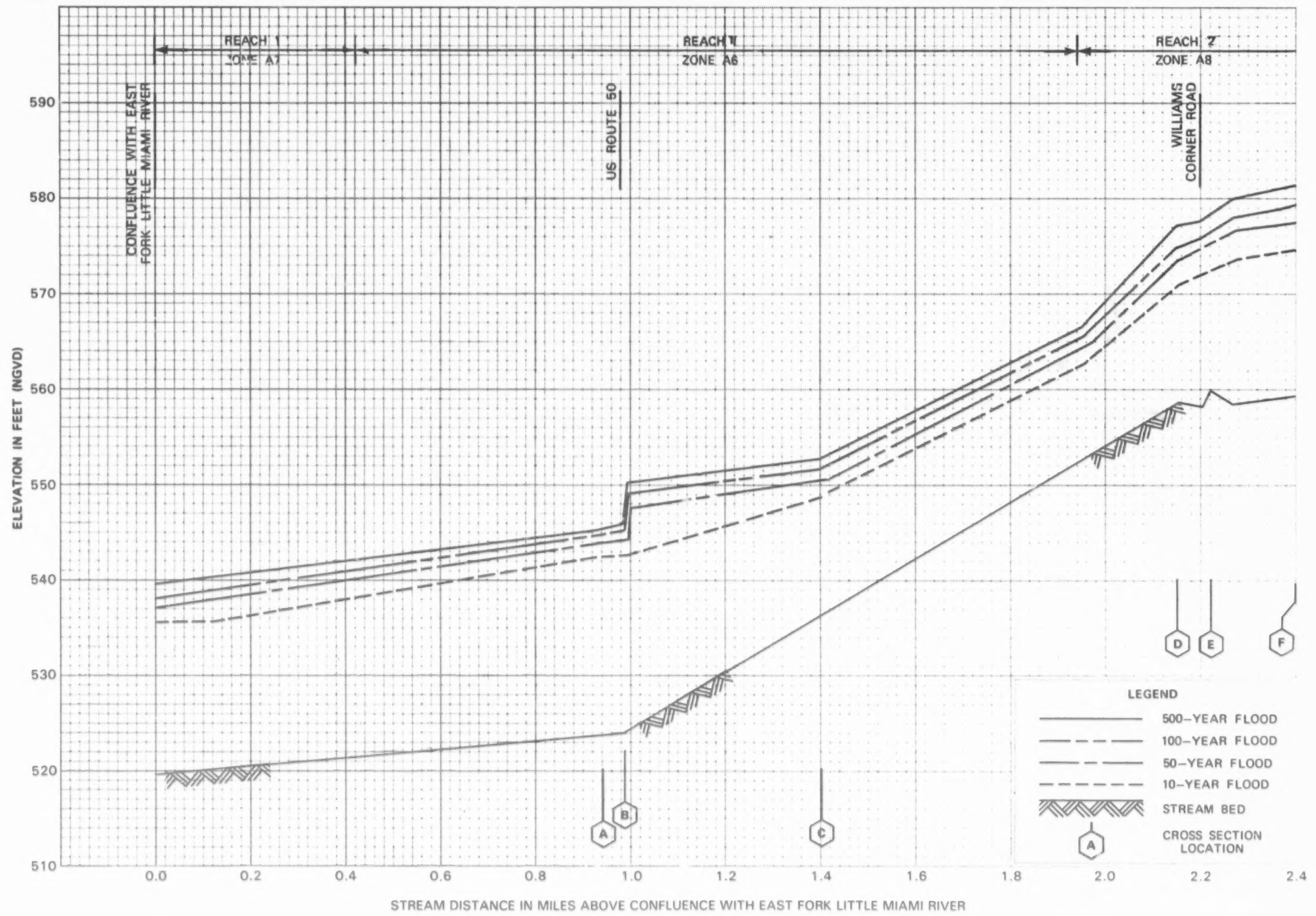


FLOOD PROFILES

BULLSKIN CREEK

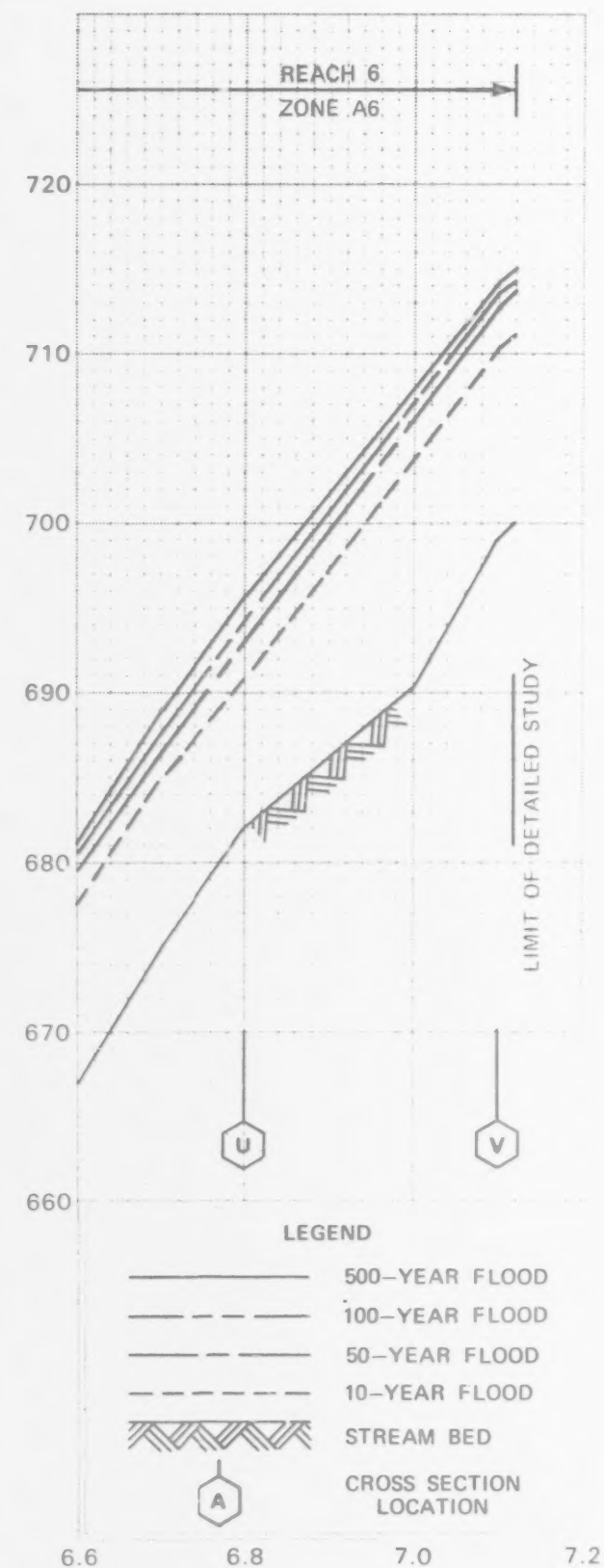
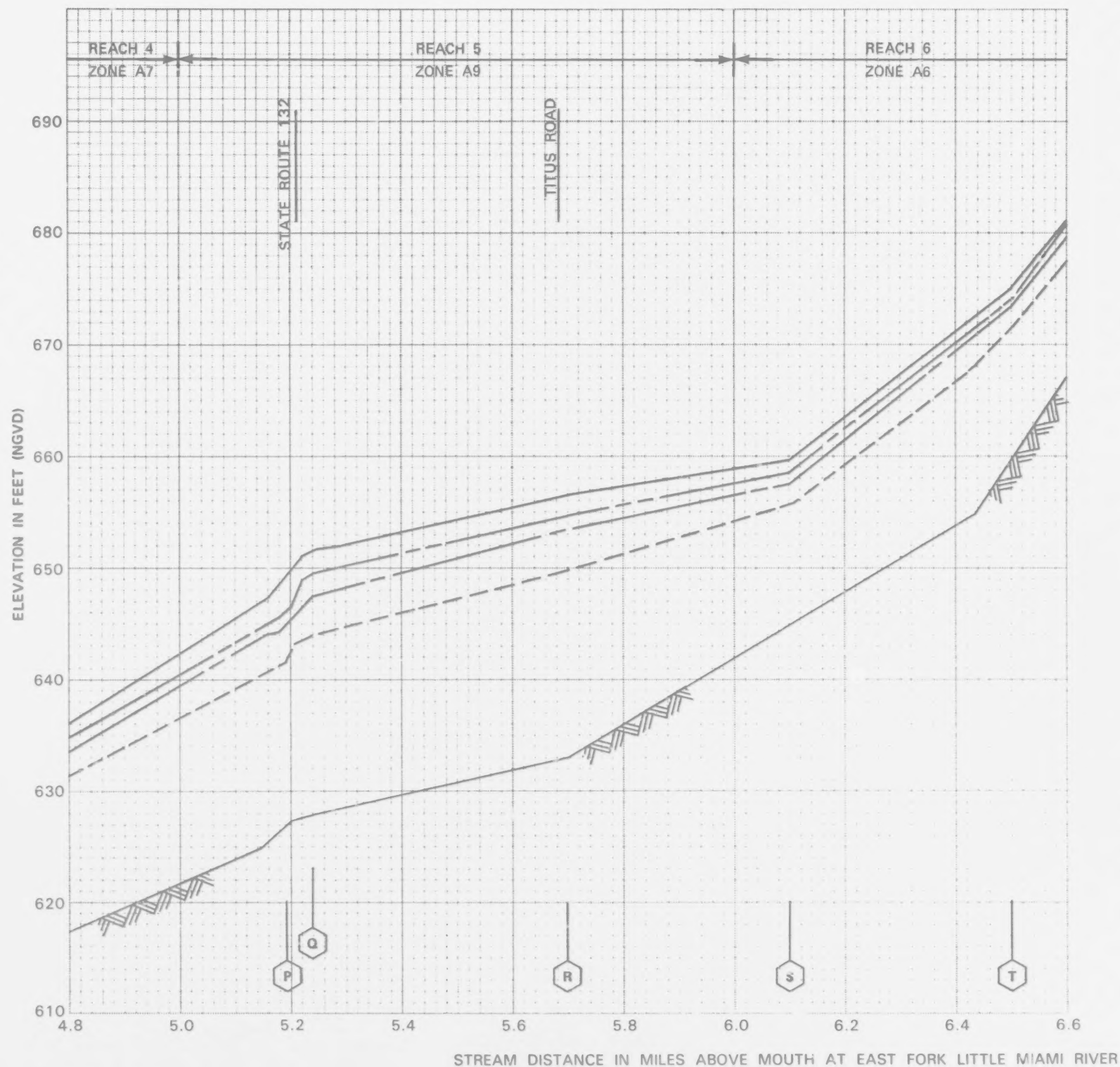
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FLOOD PROFILES
STONELICK CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY
CLERMONT COUNTY, OH
(UNINCORPORATED AREAS)



FEDERAL EMERGENCY MANAGEMENT AGENCY

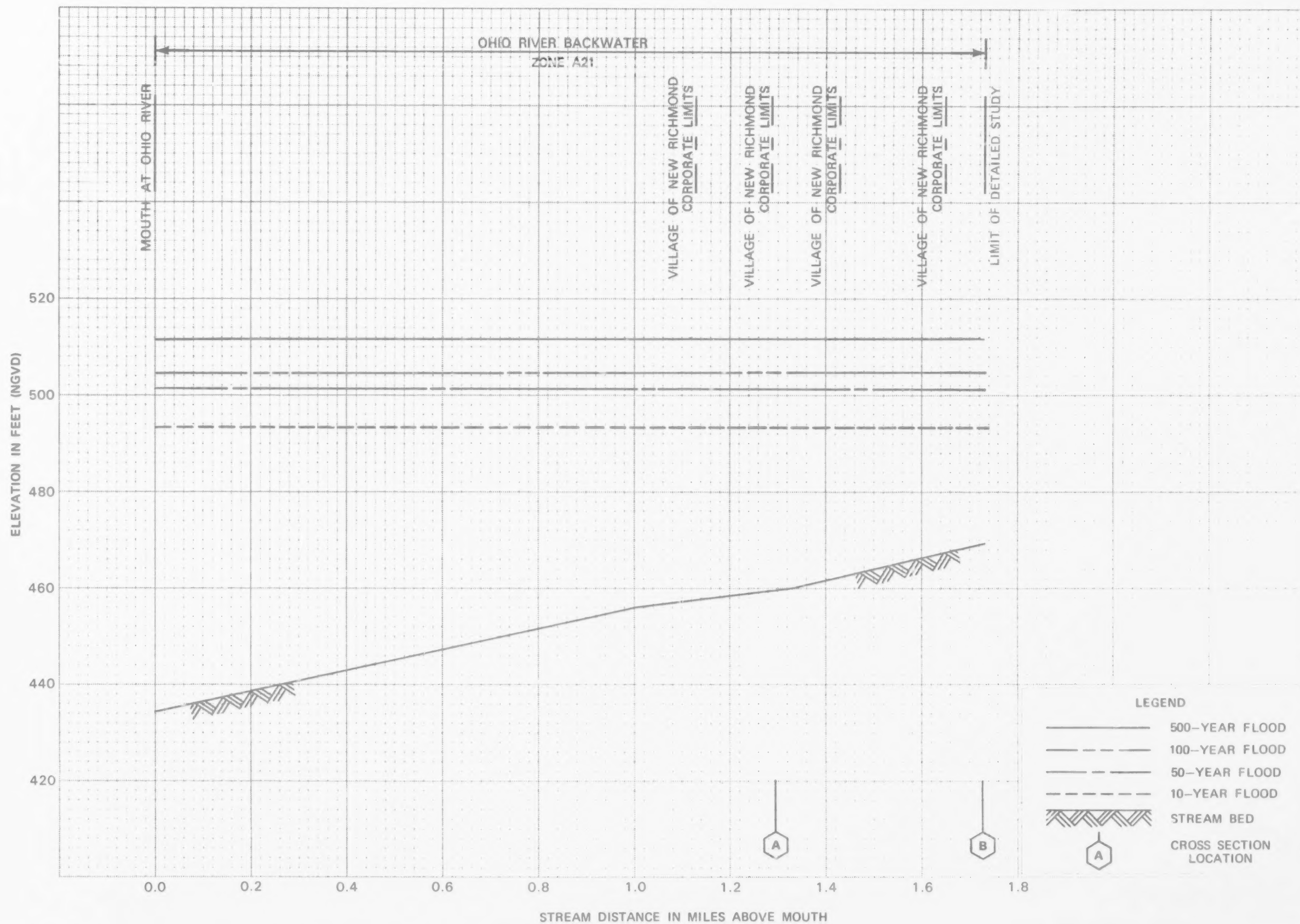
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(UNINCORPORATED AREAS)

FLOOD PROFILES

STONELICK CREEK

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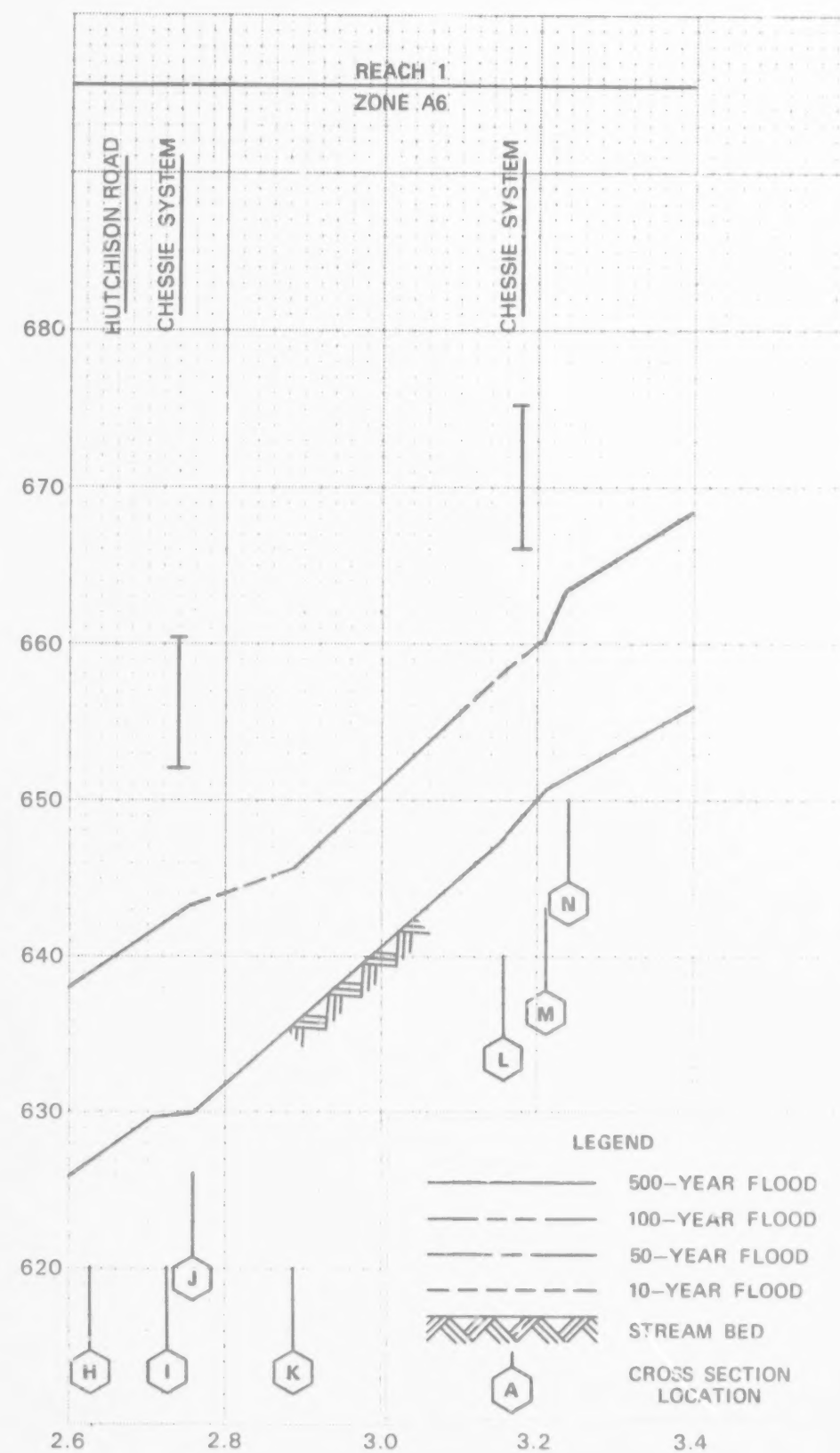
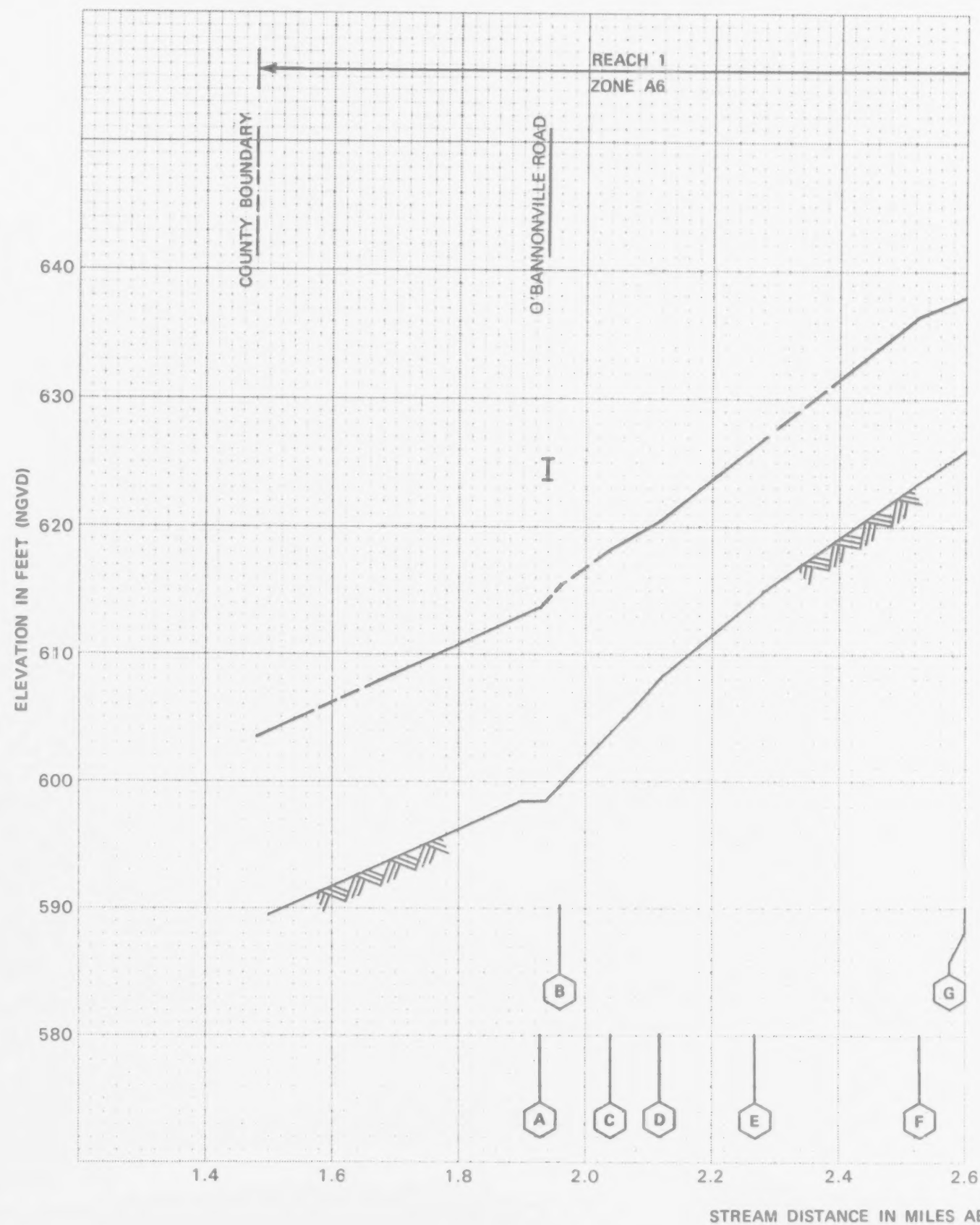
FLOOD PROFILES

TWELVEMILE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLERMONT COUNTY, OH
(UNINCORPORATED AREAS)

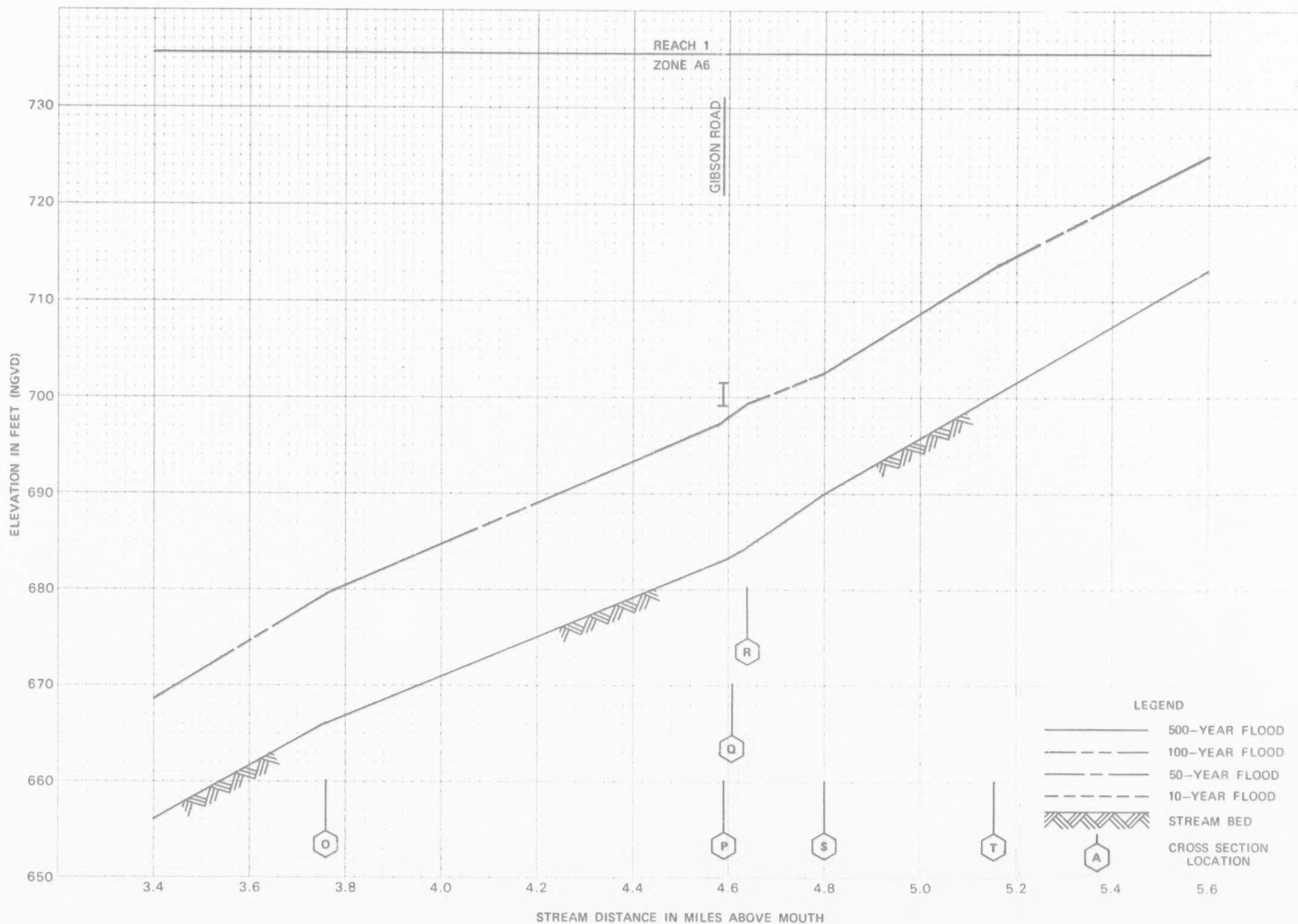
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FLOOD PROFILES
O'BANNON CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY
CLERMONT COUNTY, OH
(UNINCORPORATED AREAS)

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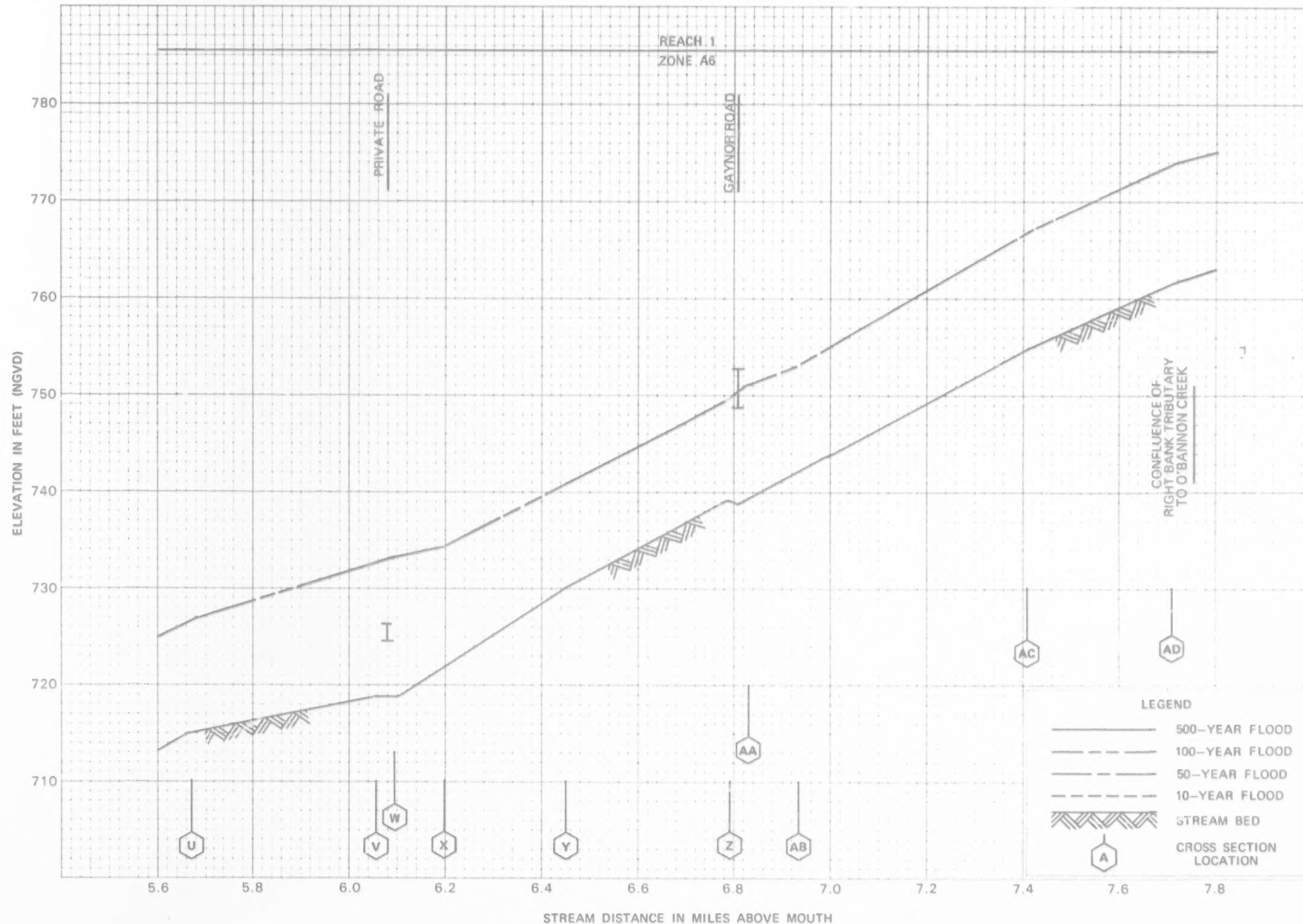
FLOOD PROFILES

O'BANNON CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLERMONT COUNTY, OH
(UNINCORPORATED AREAS)

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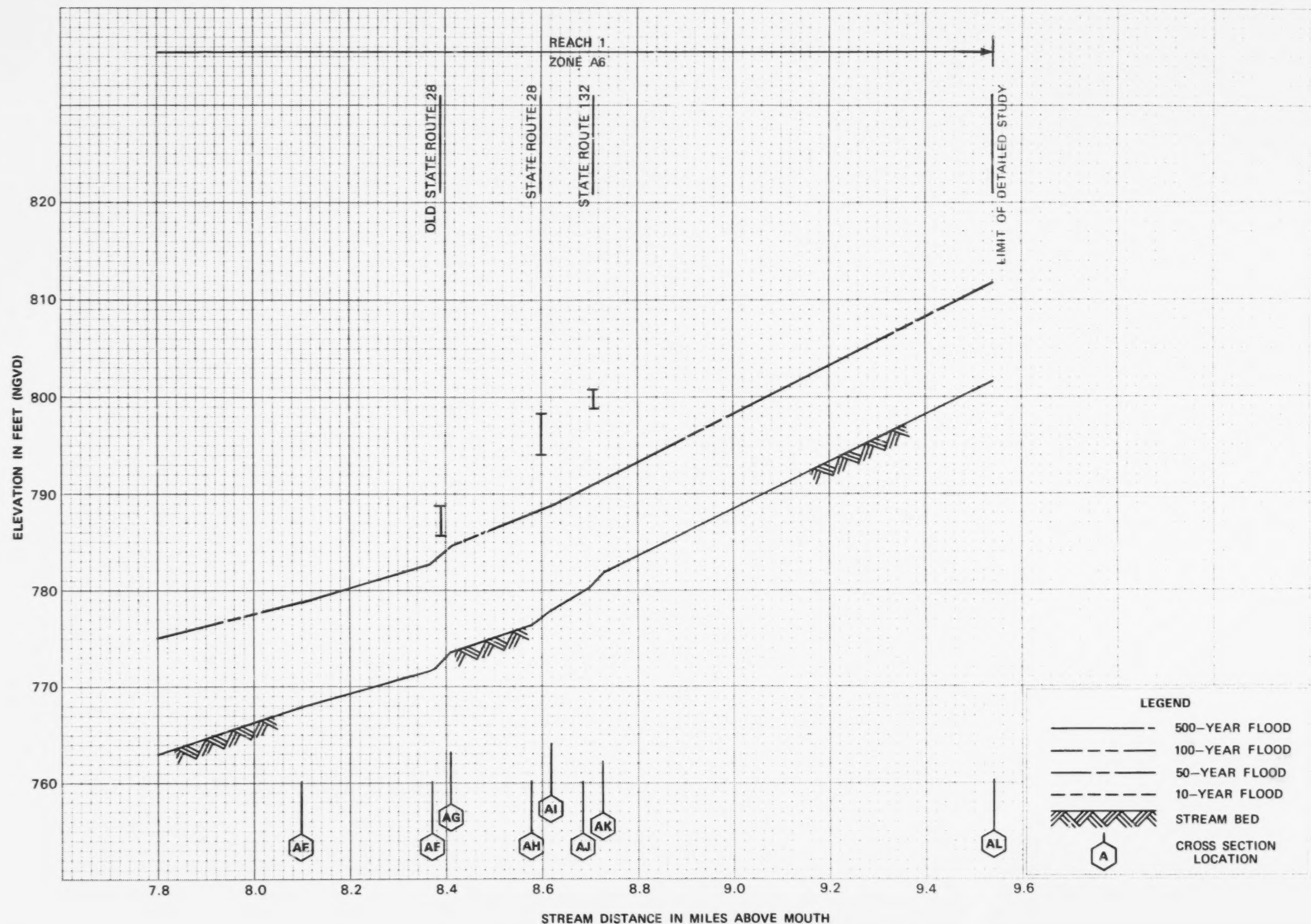


FLOOD PROFILES

O'BANNON CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLERMONT COUNTY, OH
(UNINCORPORATED AREAS)



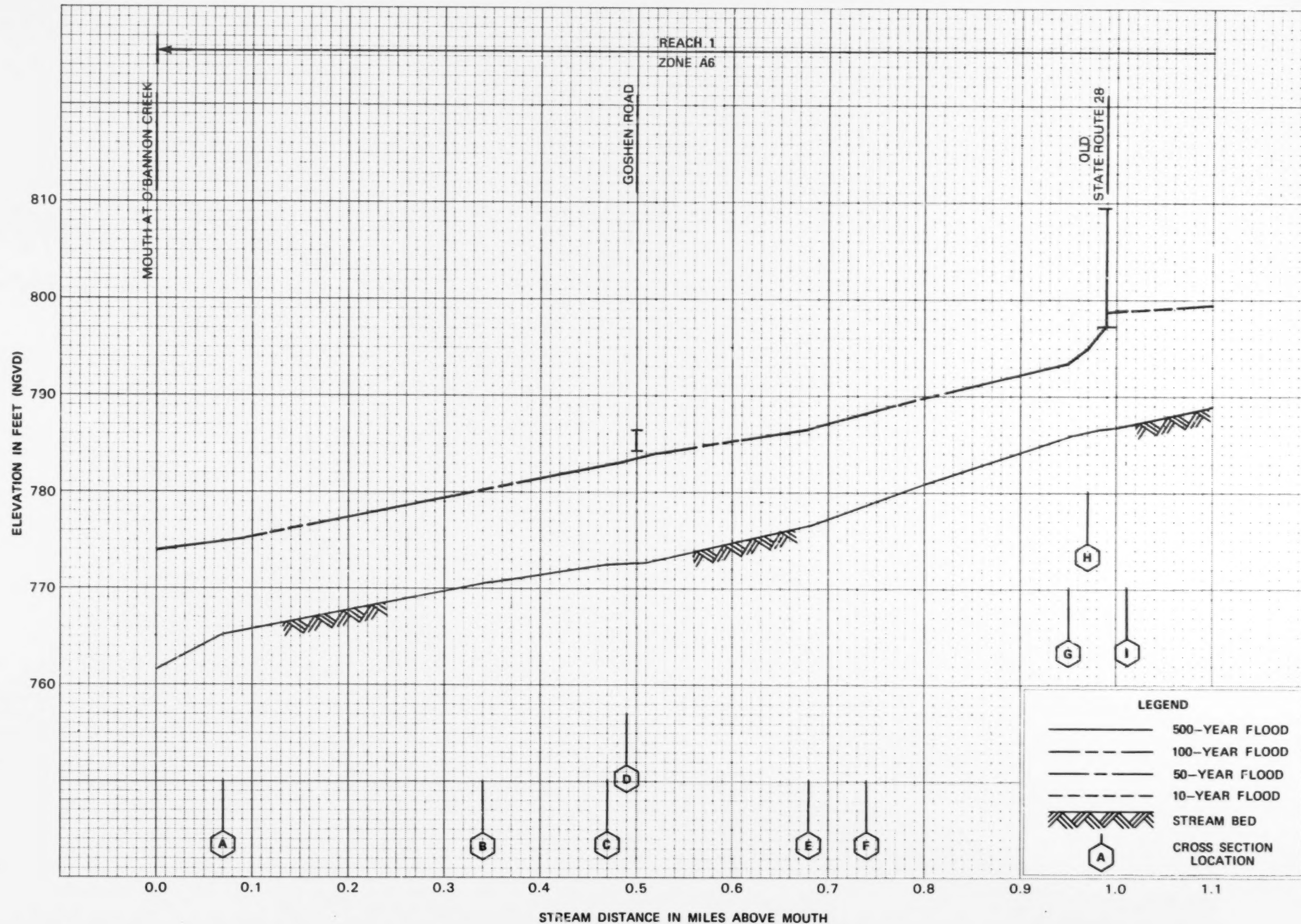
FLOOD PROFILES

O'BANNON CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLERMONT COUNTY, OH
(UNINCORPORATED AREAS)

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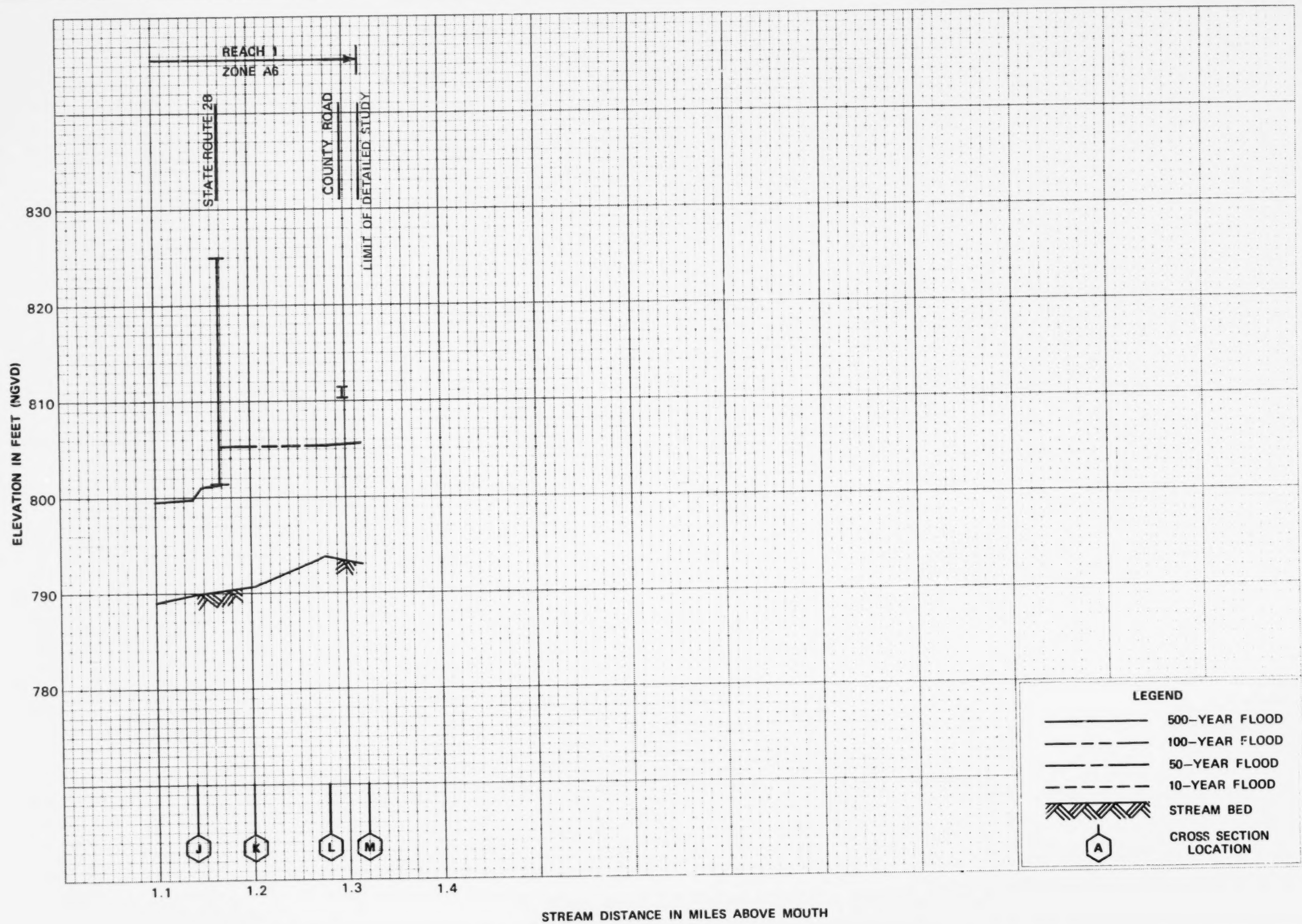


FLOOD PROFILES

RIGHT BANK TRIBUTARY TO O'BANNON CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CLERMONT COUNTY, OH
(UNINCORPORATED AREAS)



FLOOD PROFILES

RIGHT BANK TRIBUTARY TO O'BANNON CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

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